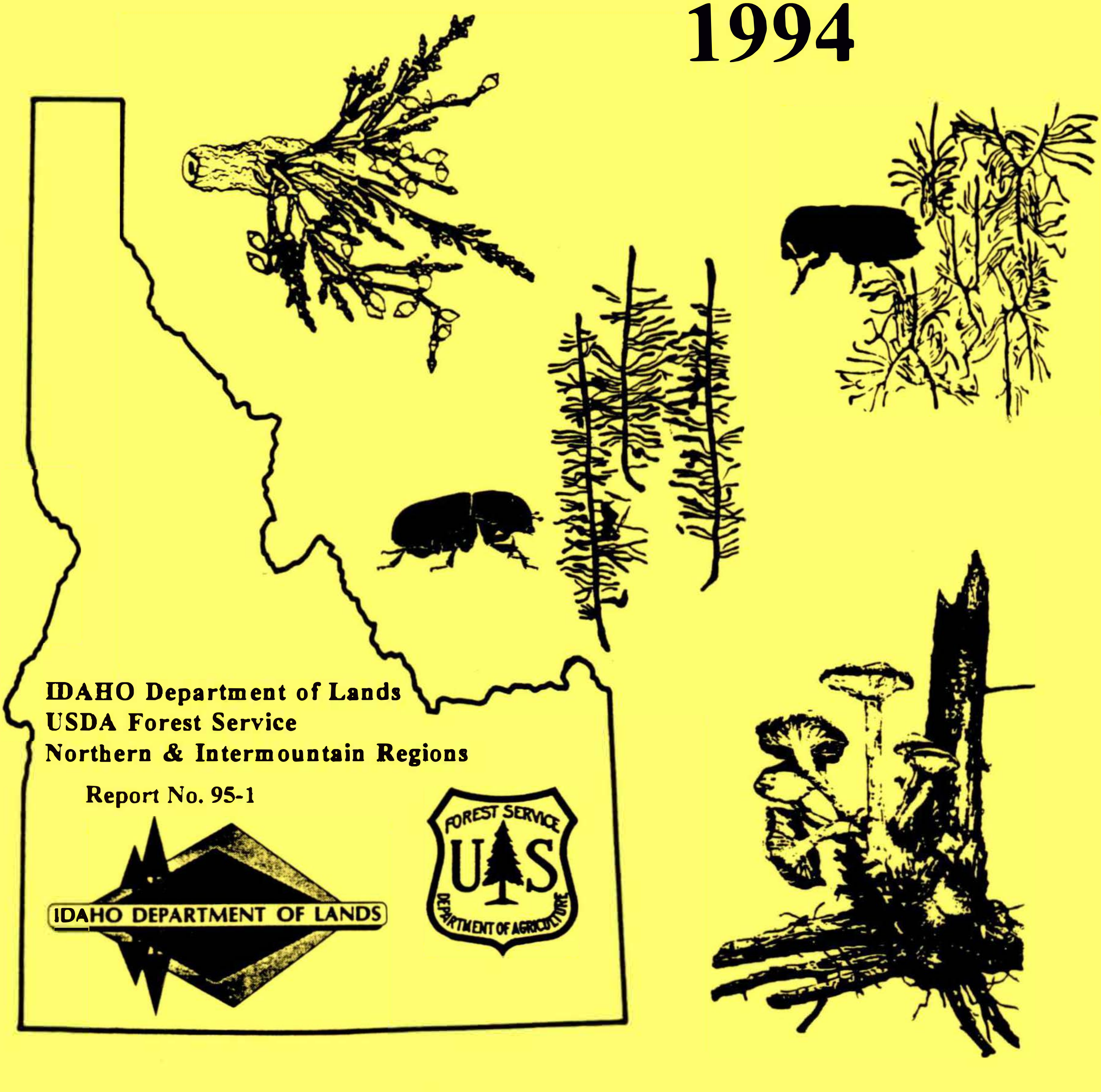
IDAHO FOREST INSECT & DISEASE CONDITIONS & PROGRAM SUMMARY 1994



IDAHO Department of Lands
USDA Forest Service
Northern & Intermountain Regions

Report No. 95-1

IDAHO FOREST INSECT AND DISEASE CONDITIONS AND PROGRAM SUMMARY

1994

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INTRODUCTION

This report summarizes major insect and disease damage on forested lands of all ownerships within the State of Idaho for 1994. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by insect and disease specialists within the USDA Forest Service and the Idaho Department of Lands. Losses listed or reported in tables are only estimates. Likewise, maps outlining areas of major insect infestations provide general locations of problems.

This report also includes brief descriptions of projects insect and disease specialists are conducting in addition to the training and other technical assistance provided on a regular basis.

CONDITIONS IN BRIEF

FOREST INSECTS

In 1993 the weather patterns were very favorable to insect development. The warm, dry spring and summer that persisted into October made it especially suitable for bark beetles, at least for the pine engraver. From the bark beetle tables, all beetle activity, except for the pine engraver, was down. This may have been in response to the cool, wet spring and summer of 1993. However, the pine engraver, with its potential for multiple generations per year, appears to have responded to the favorable conditions. State wide, populations of this beetle are very high and, further more, thousands of additional trees faded during the fall and early winter, after the aerial survey was finished.

Defoliator populations are at record low levels in 1994, with no visible defoliation being recorded anywhere in the state.

FOREST DISEASES

Since disease mortality is not usually as apparent as insect outbreaks or forest fires, the extent of losses from diseases is difficult to measure accurately. Root diseases, white pine blister rust, dwarf mistletoes, and nursery diseases continue to cause serious problems throughout much of the state. Although impacts may be quite severe, the aerial surveys which provide most of the data for this report do not usually record these diseases because they are difficult to detect from the air.

However, aerial surveys will record needle diseases during years of widespread infection and 1994 was a severe year for pine needle casts. Thousands of acres of lodgepole pine and ponderosa pine were severely infected in north Idaho. This was the fourth or fifth consecutive year of high infection for some of these areas, but little mortality has been observed. White pine was also severely infected in some areas, but larch appeared to be relatively free from the needle diseases which have infected it in the past.

FOREST INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE

In northern Idaho, total tree mortality attributed to the mountain pine beetle declined dramatically from over 16,600 trees on 7,600 acres in 1993 to just over 3,300 trees on 3,400 acres in 1994 (Table 1a, Figure 1). This decline was expected for most bark beetle species. The abnormally cool, wet summer of 1993 had a detrimental affect on insect populations in general, which is reflected a year later for bark beetles because of the delay in tree fading.

In western white pine, beetle activity decreased from over 900 trees killed in 1993 to 400 in 1994. Most of these occurred on the Idaho Panhandle National Forests (IPNF's). The number of ponderosa pine killed by the mountain pine beetle decreased dramatically from over 8,000 in 1993 to about 500 in 1994. Most activity occurred on the Palouse Ranger District (RD) of the Clearwater National Forest (NF), the Coeur d'Alene Indian Reservation (IR), and on the Nez Perce NF.

A decline occurred as well in the number of lodgepole pine killed by the mountain pine beetle. Over 7,400 trees were killed in 1993 while only 2,200 were killed in 1994. Most of the activity remains on the Bonners Ferry RD, IPNF's, and on the Red River and Elk City RD's, Nez Perce NF. Permanent plots monitored on the Bonners Ferry RD showed, very little current mountain pine beetle activity. However, the beetle is quite active in several locations in the Katka Peak and Boulder Creek areas.

An increase was detected, however, in beetle activity in whitebark pine. Over 140 trees were detected in 1994 compared to just 11 in 1993. These occurred on the Bonners Ferry and Priest Lake RD's, IPNF's, and on the Salmon RD, Nez Perce NF.

In southern Idaho, a significant reduction in activity occurred with only 4,500 trees killed in 1994 compared to 41,300 during 1993 (Table 1b, Figure1). Mortality occurred in both lodgepole and ponderosa pine. Decreases occurred on all National Forest except the Caribou National Forest, where tree mortality remained static. The largest outbreak in southern Idaho continues to be located in the Sawtooth National Recreation Area on the Sawtooth National Forest.

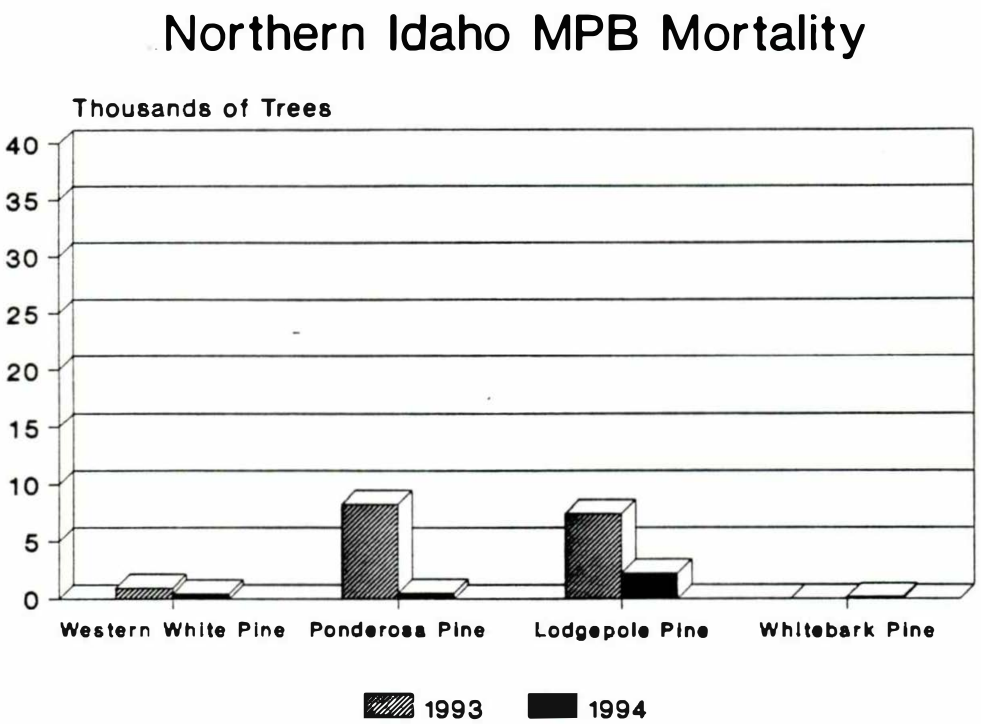
Table 1a. Idaho Statewide summary; annual mountain pine beetle (**MPB**) mortality by reporting area: **Northern Idaho.**

		MPB (white pine) Estimated Mortality			**MPB** (ponderosa pine) Estimated Mortality			**MPB** (lodgepole pine) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1994	0	0	0.0	2	5	0.4	4	3	0.3
	1993	0	0	0.0	12	23	1.8	6	20	1.8
Cataldo	1994	6	4	1.6	2	6	0.5	10	15	1.3
	1993	2	20	8.0	33	92	7.4	13	160	14.4
Clearwater	1994	36	44	17.6	106	100	8.0	67	174	15.7
	1993	68	71	28.4	4	3	0.2	562	270	24.3
CPTPA*	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	47	100	9.0
Craig Mtns.	1994	0	0	0.0	0	0	0.0	45	210	18.9
	1993	0	0	0.0	564	3,880	310.4	629	1,161	104.5
Panhandle	1994	385	373	149.2	59	64	5.1	1,309	1,045	94.0
	1993	560	812	324.8	491	609	48.7	2,040	2,425	218.3
Kendrick	1994	0	0	0.0	0	0	0.0	4	15	1.3
	1993	0	0	0.0	0	0	0.0	2	10	0.9
Kootenai Valley	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	6	6	2.4	127	270	21.6	141	179	16.1
Maggie Creek	1994	0	0	0.0	2	3	0.2	0	0	0.0
	1993	0	0	0.0	4	15	1.2	2	10	0.9
Mica	1994	2	1	0.4	0	0	0.0	10	42	3.8
	1993	4	6	2.4	450	666	53.3	206	1,158	104.2
Nez Perce	1994	8	12	4.8	110	130	10.4	550	510	45.9
	1993	8	9	3.6	476	1,158	92.6	488	573	51.6
Pend Oreille	1994	4	2	0.8	4	15	1.2	134	123	11.1
	1993	62	22	8.8	107	225	18.0	199	1,039	93.5
Priest Lake	1994	2	2	0.8	51	95	7.6	0	0	0.0
	1993	0	0	0.0	0	0	0.0	2	5	0.4
West St. Joe	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	187	200	16.0	76	315	28.3
Coeur d'Alene IR	1994	0	0	0.0	133	100	8.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce IR	1994	0	0	0.0	0	0	0.0	14	70	6.3
	1993	0	0	0.0	73	1,125	90.0	0	0	0.0
North Idaho Totals	1994	**443**	**438**	**175.2**	**469**	**518**	**41.4**	**2,146**	**2,207**	**198.6**
	1993	710	946	378.4	2,528	8,266	661.2	4,413	7,425	668.2

* Clearwater-Potlatch Timber Protective Association

Table 1b. Idaho Statewide summary; annual mountain pine beetle (**MPB**) mortality by reporting area: **Southern Idaho.**

		MPB (whitebark pine) Estimated Mortality			**MPB** (ponderosa pine) Estimated Mortality			**MPB** (lodgepole pine) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1994	70	98	10.8	0	0	0.0	10	25	1.5
	1993	125	250	27.5	200	200	8.0	875	1,350	86.4
Caribou	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	25	50	5.5	0	0	0.0	475	850	54.4
Challis	1994	125	151	16.6	0	0	0.0	240	362	21.7
	1993	150	325	35.8	0	0	0.0	2,150	3,975	254.4
Payette	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	1,800	2,000	220.0	1,200	1,700	68.0	400	600	38.4
Salmon	1994	20	28	3.1	2,066	1,855	74.2	110	156	9.4
	1993	50	100	11.0	200	300	12.0	1,250	2,400	153.6
Sawtooth	1994	145	203	22.3	0	0	0.0	758	1,067	64.0
	1993	125	250	27.5	0	0	0.0	9,875	17,950	1,148.8
Targhee	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	50	50	5.5	0	0	0.0	250	450	28.8
Other Lands	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	200	300	19.2
South Idaho Totals	1994	360	480	52.8	2,066	1,855	74.2	1,118	1,610	96.6
	1993	2,425	3,125	343.8	4,000	3,200	128.0	29,675	34,975	2,238.4
State Totals	1994	**803**	**918**	**228.0**	**2,535**	**2,293**	**249.4**	**3,264**	**3,817**	**295.2**
	1993	2,431	3,136	345.0	6,528	11,466	789.2	34,088	42,400	2,906.6
State Totals (white pine)	1994	**443**	**438**	**175.2**						
	1993	710	946	378.4						



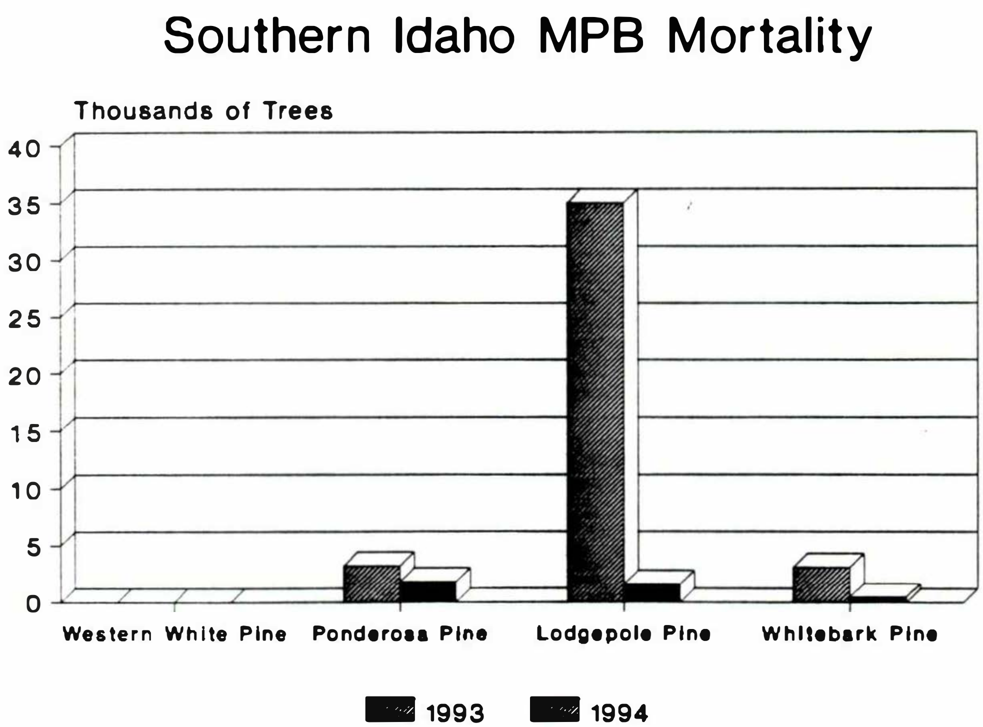


Figure 1. Northern and Southern Idaho
Mountain Pine Beetle Mortality
by Host Species 1993 - 1994

PINE ENGRAVER\WESTERN PINE BEETLE

From the air, the dead tree groups caused by these two beetles are often indistinguishable, at least when the attacks are in second growth ponderosa pine stands. For this reason, they will be treated jointly in this write-up. In north Idaho, activity of these two beetles, as interpreted from 1993 attacked trees that faded and were recorded in the 1994 surveys, was down very significantly compared to the previous year. Ips killed trees (ponderosa and lodgepole pine) tallied 7,542 on 859 acres in 1993 compared to 1,083 on 179 acres in 1994 (Table 2a, Figure 2), and western pine beetle killed trees were 13,350 on 3,880 acres in 1993 compared to 8,240 on 2,110 acres in 1994. This reduction in activity was probably due to the very cool, wet spring and summer of 1993. These conditions limited the success of the beetles preventing new attacks, resulting in fewer dead trees in 1994 surveys.

However, during the late summer, fall, and winter of 1994, well after the surveys were concluded, thousands of ponderosa pine in hundreds of dead tree groups began to fade and have become the cause of great concern. This high level of beetle killed trees will show up in the 1995 surveys. The cause of this great increase in activity appears to be correlated with the very prolonged and very hot, dry summer of 1994. Pine engraver flight monitoring studies in 1994 showed normal spring activity with very high activity in the late summer and fall. There were four flights in 1994 in the study area.

Ground checking of these groups has shown them to be primarily due to the pine engraver with some concurrent activity by the western pine beetle. At times both beetles were found in trees within the same dead tree group, but not in the same tree. When western pine beetles were found, it appeared they were the only beetle present. This was judged to be the case from sampling trees cut at other sites where the western pine beetle attacks were continuous from the base up to a 3-4" diameter top. In the 1994 attacked trees woodpecker activity from the base to high in the tree suggested the same pattern of attack.

The pine engraver attacks in ponderosa pine are most often confined to that portion of the tree having branches. Thus, when sampling pine engraver killed trees, the lower bole is usually free of attacks and appears healthy. However, felling the trees to allow sampling of the bole within the crown always shows attacks of the pine engraver to be present. Occasionally these attacks will also be found in the lower bole.

This attack pattern of the pine engraver in standing trees, that of having the beetles working primarily in the bole of the crown of the tree, leaving the lower bole free of attacks has been consistent throughout Idaho and Montana. In prior years we have followed trees killed by the pine engraver to see what other insects might attack these lower boles. There has always been a question as to the fate of the lower boles of these pine engraver killed trees. "Will they be attacked by more pine engravers, by other bark beetles, or by secondary insects only?" In prior years we have followed samples of these trees and consistently found them to be attacked only by secondary insects, primarily species of *Hylastes* and *Hylergops*, and species of Cerambicids and Buprestids. We have never seen attacks by any species of *Dendroctonus*, and only rarely by other *Ips* species.

Increases of ground detections of pine engraver beetle occurred on the Boise and Payette National Forest in southern Idaho (Table 2b, Figure 2).

SPRUCE BEETLE

There were low levels of spruce beetle activity in northern Idaho in 1994. Only 64 faded trees were detected on 108 acres (Table 2a, Figure 2). Activity occurred in small scattered groups on the Bitteroot, Nez Perce, Clearwater, and Idaho Panhandle NFs and on the Cataldo Fire Protection District. The only notable increase in spruce beetle activity occurred on the North Fork RD of the Clearwater NF where 68 trees on 61 acres were faded in 1994 compared with 2 trees on 2 acres in 1993.

Mortality from spruce beetle infestation decreased during 1994 with 45,100 trees killed compared to 58,200 in 1993. This decrease was attributed to a decline in host type on the Payette National Forest due to recent outbreaks and extensive wildfire in infested areas. No significant mortality was reported on any other forest in southern Idaho (Table 2b, Figure2).

Table 2a. Idaho Statewide summary; annual bark beetle mortality by reporting area: **Northern Idaho.**

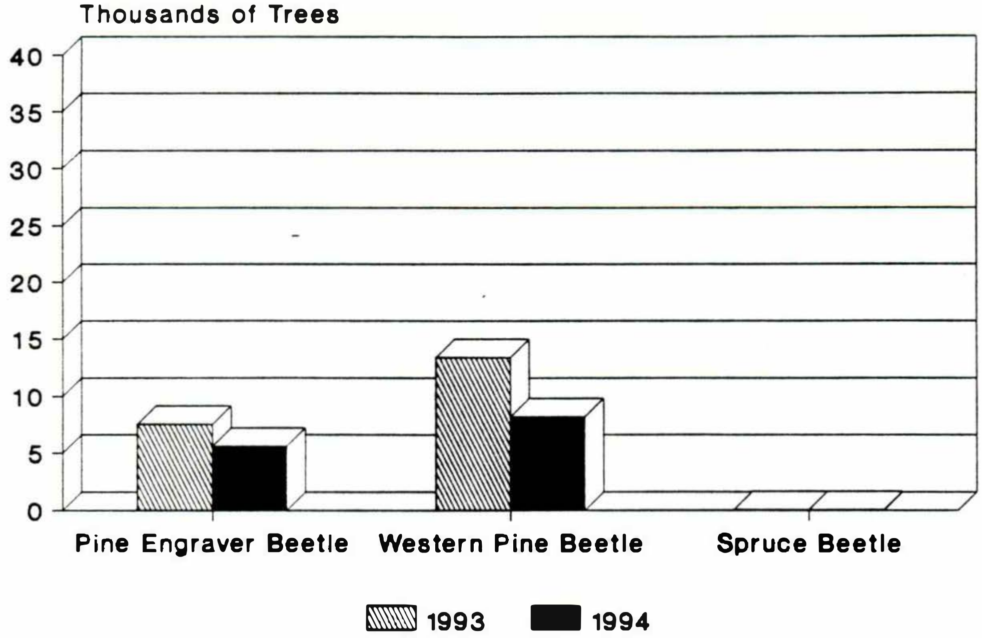
		Pine Engraver Beetle Estimated Mortality(PP&LPP)			**Western Pine Beetle** Estimated Mortality			**Spruce Beetle** Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1994	0	0	0.0	0	0	0.0	2	2	0.8
	1993	0	0	0.0	8	4	1.6	0	0	0.0
Cataldo	1994	2	30	2.7	26	88	35.2	20	10	4.0
	1993	0	0	0.0	4	15	6.0	0	0	0.0
Clearwater	1994	2	10	0.3	28	66	26.4	61	28	11.2
	1993	0	0	0.0	6	3	1.2	4	7	2.8
CPTPA*	1994	41	100	2.5	63	345	138.0	0	0	0.0
	1993	8	65	1.6	130	156	62.4	0	0	0.0
Craig Mtns.	1994	16	215	6.3	155	725	290.0	0	0	0.0
	1993	126	665	16.6	367	1,657	662.8	0	0	0.0
Panhandle	1994	15	37	3.0	279	459	250.0	25	24	9.6
	1993	7	110	2.8	142	625	250.0	18	31	12.4
Kendrick	1994	2	25	0.6	62	353	183.6	0	0	0.0
	1993	8	50	1.3	143	636	254.4	0	0	0.0
Kootenai Valley	1994	0	0	0.0	6	8	3.2	0	0	0.0
	1993	8	75	1.9	2	1	0.4	0	0	0.0
Maggie Creek	1994	0	0	0.0	44	236	94.4	0	0	0.0
	1993	0	0	0.0	20	66	26.4	0	0	0.0
Mica	1994	220	2,451	212.2	207	1,142	456.8	0	0	0.0
	1993	521	5,397	134.9	1,085	5,829	2,331.6	0	0	0.0
Nez Perce	1994	55	91	2.3	473	582	232.8	0	0	0.0
	1993	29	60	1.5	346	457	182.8	90	40	16.0
Pend Oreille	1994	144	2,131	189.9	158	480	192.0	0	0	0.0
	1993	78	720	18.0	212	1,049	419.6	0	0	0.0
Priest Lake	1994	0	0	0.0	20	65	26.0	0	0	0.0
	1993	0	0	0.0	4	6	2.4	0	0	0.0
West St. Joe	1994	2	10	0.9	36	105	42.0	0	0	0.0
	1993	74	400	10.0	464	2,035	814.0	0	0	0.0
Coeur d'AleneIR	1994	0	0	0.0	58	206	82.4	0	0	0.0
	1993	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce IR	1994	38	500	12.5	496	3,379	1,351.6	0	0	0.0
	1993	0	0	0.0	949	814	325.6	0	0	0.0
North Idaho Totals	1994	**537**	**5,600**	**433.6**	**2,111**	**8,239**	**3,295.6**	**108**	**64**	**25.6**
	1993	859	7,542	188.6	3,882	13,353	5,341.2	112	78	31.2

* Clearwater-Potlatch Timber Protective Association.

Table 2b. Idaho Statewide summary; annual bark beetle mortality by reporting area: **Southern Idaho.**

		Pine Engraver Beetle Estimated Mortality			Western Pine Beetle Estimated Mortality			Spruce Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1994	750	750	7.5	2,250	2,250	1,237.5	0	0	0.0
	1993	2,300	3,375	33.8	6,900	10,125	5,568.8	500	500	239.0
Caribou	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	0	0	0.0
Challis	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	0	0	0.0
Payette	1994	200	275	2.8	600	825	453.8	4,800	8,700	4,176.0
	1993	425	750	7.5	1,275	2,250	1,237.5	35,600	35,200	16,825.6
Salmon	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	60	84	40.2
Sawtooth	1994	100	75	0.8	300	225	123.8	0	0	0.0
	1993	475	500	5.0	1,425	1,500	825.0	10	14	6.7
Targhee	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	20	28	13.4
Other Lands	1994	0	0	0.0	0	0	0.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	0	0	0.0
South Idaho Totals	1994	1,050	1,100	11.0	5,400	4,725	2,598.8	4,800	8,700	4,176.0
	1993	3,200	4,625	46.3	9,600	13,875	7,631.3	36,100	35,700	17,064.6
State Totals	**1994**	**4,059**	**12,167**	**234.9**	**7,511**	**12,964**	**5,894.4**	**4,908**	**8,764**	**4,201.6**
	1993	886	902	9.4	13,482	27,228	12,972.5	36,212	35,778	17,095.8

Northern Idaho Pine and Spruce Mortality



Southern Idaho Pine and Spruce Mortality

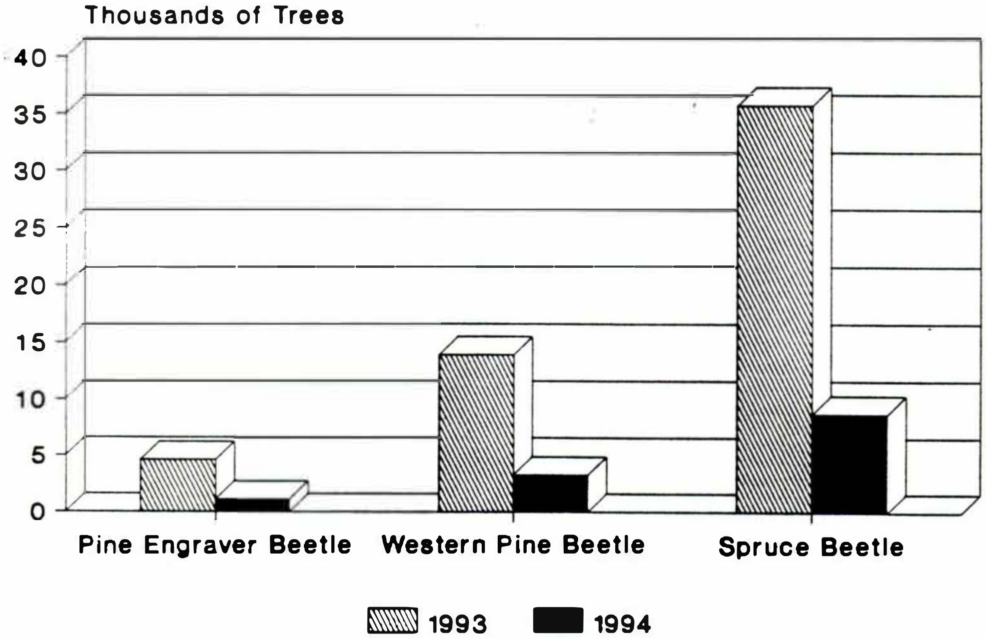


Figure 2. Northern and Southern Idaho
Pine and Spruce Mortality
by Bark Beetle Species 1993 - 1994

Table 3. Estimated spruce beetle caused mortality, 1985 - 1994

		ESTIMATED MORTALITY		
Forest and Adjacent Lands	YEAR	Acres Infested	Trees	MBF Volume
Boise	1985	55	84	40.2
	1986	--	1,095	523.4
	1987	607	669	319.8
	1988	155	254	121.4
	1989	175	227	108.5
	1990	100	40	19.1
	1991	0	0	0.0
	1992	571	141	67.4
	1993	500	500	239.0
	1994	0	0	0.0
Payette	1985	3,881	13,775	6,584.4
	1986	--	12,600	6,022.8
	1987	13,002	15,873	7,587.3
	1988	36,364	44,756	21,393.4
	1989	26,451	32,108	15,347.6
	1990	152,810	185,460	88,649.9
	1991	36,100	23,800	11,376.4
	1992	31,155	31,719	15,161.7
	1993	35,600	35,200	16,825.6
	1994	4,600	8,700	4,158.6
Totals	**1985-1994**	**342,126**	**407,001**	**194,546.5**

DOUGLAS-FIR BEETLE

Populations of the Douglas-fir beetle were similar in 1994 to what they were in 1993 with 7363 faded trees visible over 2485 acres (Table 4a, Figure 3). Most of the detected activity was in small scattered groups. The only notable increase occurred on the Clearwater NF where 2662 faded trees were visible over 717 acres in 1994 compared to 488 faded trees detected over 103 acres in 1993. Increases were noted on the Pierce, Palouse, and Powell RDs of the Clearwater and on the Wallace, Sandpoint, and Bonners Ferry RDs of the Idaho Panhandle NF.

Mortality decreased by two-fold from 1993 in southern Idaho. Outbreaks were located on the Boise, Caribou, Sawtooth, and Payette National Forests (Table 4b, Figure3).

FIR ENGRAVER

Fir engraver killed trees were down from 9462 in 1993 to 7841 in 1994, but the trees were more widely scattered through 7063 acres in 1994 as opposed to 6450 acres in 1993 (Table 4a, Figure 3).

Fir engraver activity increased on the Idaho Panhandle and Clearwater NFs as well as the Clearwater/Potlatch, Kendrick, Mica, and Priest Lake fire protection districts. Populations were most notable on the Nez Perce NF (Salmon River, Clearwater, and Selway RDs and adjacent State land) where 3303 faded trees were seen over 4024 acres. These figures are lower than in 1993 when 3741 faded trees were visible over 4341 acres.

Decreases in fir engraver beetle activity were observed in southern Idaho, with significant decreases in activity occurring on the Boise and Payette National Forests, and on adjacent State and private lands. Only 4,400 trees were killed in southern Idaho in 1994 compared to 67,200 trees in 1993 (Table 4b, Figure 3).

WESTERN BALSAM BARK BEETLE

There was a decline in both the number of trees and acres of forests affected by the western balsam bark beetle in 1994. A total of 3910 trees on 2882 acres were affected in 1994 vs. 4692 trees on 5084 acres in 1993 (Table 4a, Figure 3). The Avery, Fernan, St. Maries, and Sandpoint RDs of the Idaho Panhandle NF and the Salmon River and Red River RDs of the Nez Perce NF were the only areas to report increases in the number of acres and trees affected by the western balsam bark beetle.

In other areas, trees fading from western balsam bark beetle were concentrated on fewer acres. On the Clearwater NF the total number of acres affected by western balsam bark beetles declined from 511 in 1993 to 298 in 1994, but the number of fading trees increased from 460 in 1993 to 695 in 1994. Bonners Ferry RD of the Idaho Panhandle NF had half the number of acres with western balsam bark beetle activity in 1994 than in 1993, but the number of faded trees did not decrease substantially.

Pheromone traps were deployed in the Trout Creek drainage (Bonners Ferry RD, Idaho Panhandle NF) again in 1994. The trap catches indicate a population reduction in Trout Creek. Refer to the special project section for results.

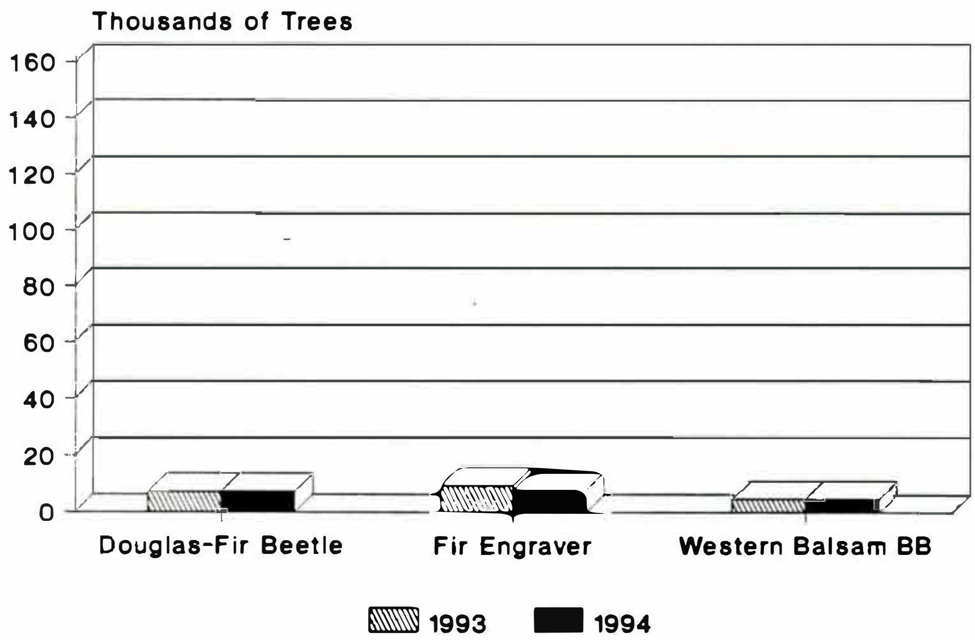
A complex of western balsam bark beetle and disease pathogens resulted in the death of subalpine fir trees throughout southern Idaho. Approximately 61,100 trees were killed during 1994 compared to 141,100 trees in 1993 in southern Idaho (Table 4b, Figure 3). Large areas of mortality are located on the Boise, Caribou, Payette, and Targhee National Forests.

Table 4a. Idaho Statewide summary; annual bark beetle mortality by reporting area: **Northern Idaho.**

		Douglas-Fir Beetle Estimated Mortality			Fir Engraver Beetle Estimated Mortality			Western Balsam Bark Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1994	156	532	186.2	0	0	0.0	0	0	0.0
	1993	206	558	195.3	0	0	0.0	6	12	1.3
Cataldo	1994	54	146	51.1	130	327	65.4	2	5	0.6
	1993	39	107	37.4	64	291	58.2	33	75	8.3
Clearwater	1994	718	2,662	931.7	326	703	140.6	299	695	76.5
	1993	103	488	170.8	116	282	56.4	520	460	50.6
CPTPA*	1994	130	660	231.0	58	155	36.0	0	0	0.0
	1993	263	1,095	383.3	107	390	78.0	14	110	12.1
Craig Mtns.	1994	24	70	24.5	30	90	18.0	0	0	0.0
	1993	109	570	199.5	419	830	166.0	0	0	0.0
Panhandle	1994	647	1,531	535.9	1,685	1,673	334.6	1,912	2,254	247.9
	1993	384	1,545	540.8	544	952	190.4	3,448	2,468	271.5
Kendrick	1994	8	40	14.0	40	135	27.0	0	0	0.0
	1993	250	990	346.5	142	455	91.0	0	0	0.0
Kootenai Valley	1994	2	12	4.2	4	11	2.2	0	0	0.0
	1993	6	9	3.1	6	12	2.4	18	15	1.6
Maggie Creek	1994	16	53	18.5	316	93	18.6	2	2	0.2
	1993	18	60	21.0	54	98	19.6	0	0	0.0
Mica	1994	12	30	10.5	120	281	56.2	0	0	0.0
	1993	25	105	36.8	344	1,180	236.0	0	0	0.0
Nez Perce	1994	424	652	228.2	4,023	3,301	660.2	610	714	78.5
	1993	522	821	287.3	4,342	3,741	748.2	941	1,105	121.5
Pend Oreille	1994	38	105	36.8	46	121	24.2	0	0	0.0
	1993	8	18	6.3	38	91	18.2	0	0	0.0
Priest Lake	1994	59	230	80.5	10	25	5.0	67	240	26.4
	1993	59	295	103.3	4	10	2.0	105	448	49.3
West St. Joe	1994	150	480	168.0	206	706	141.2	0	0	0.0
	1993	143	525	183.8	264	1,115	223.0	0	0	0.0
Coeur d'AleneIR	1994	32	140	49.0	50	160	32.0	0	0	0.0
	1993	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce IR	1994	15	20	7.0	18	60	12.0	0	0	0.0
	1993	9	35	12.3	6	15	3.0	0	0	0.0
North Idaho Totals	1994	**2,485**	**7,363**	**2,577.0**	**7,063**	**7,841**	**1,568.2**	**2,882**	**4,692**	**516.1**
	1993	2,144	7,221	2,527.3	6,450	9,462	1,892.4	5,085	4,693	516.2

* Clearwater-Potlatch Timber Protective Association

Northern Idaho Fir Mortality



Southern Idaho Fir Mortality

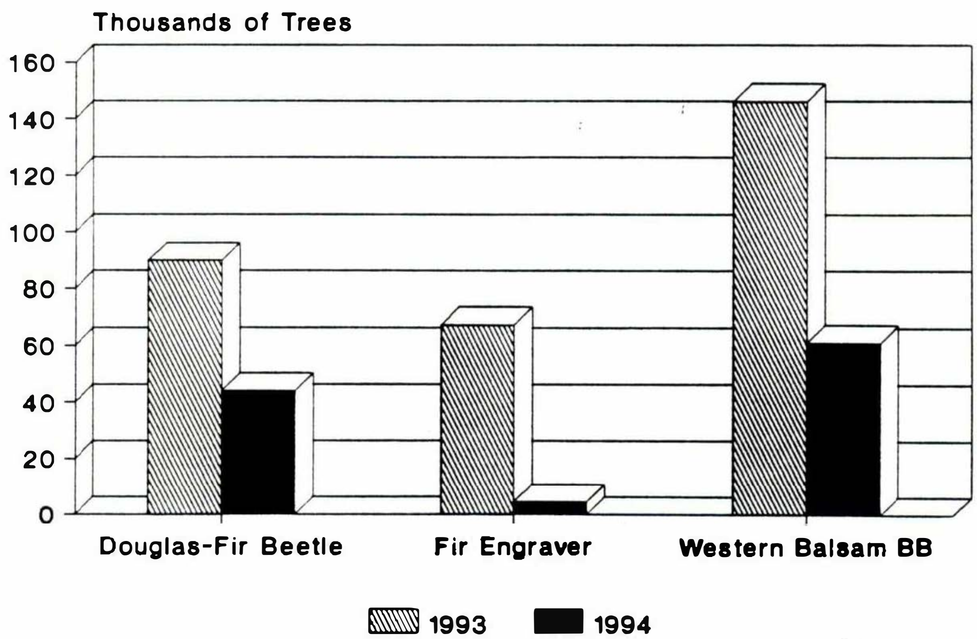


Figure 3. Northern and Southern Idaho
Fir Mortality
by Bark Beetle Species 1993 - 1994

Table 4b. Idaho Statewide summary; annual bark beetle mortality by reporting area: Southern Idaho.

		Douglas-Fir Beetle Estimated Mortality			Fir Engraver Beetle Estimated Mortality			Western Balsam Bark Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1994	16,300	18,100	2,534.0	1,400	500	95.0	4,800	3,200	352.0
	1993	43,300	37,900	5,381.0	31,100	65,700	12,483.0	12,300	9,600	1,056.0
Caribou	1994	900	1,600	224.0	0	0	0.0	4,800	12,100	1,331.0
	1993	3,400	4,500	639.0	0	0	0.0	15,700	29,900	3,289.0
Challis	1994	100	200	28.0	0	0	0.0	500	700	77.0
	1993	500	900	127.8	0	0	0.0	3,900	8,300	913.0
Payette	1994	2,200	4,000	560.0	0	0	0.0	1,000	1,400	154.0
	1993	17,800	16,700	2,371.4	1,800	1,500	285.0	1,900	1,800	198.0
Salmon	1994	800	1,400	198.8	0	0	0.0	400	600	66.0
	1993	1000	1,400	198.8	0	0	0.0	700	1,900	209.0
Sawtooth	1994	13,900	16,800	2,352.0	0	0	0.0	23,100	26,700	2,937.0
	1993	10,000	22,000	3,124.0	0	0	0.0	22,700	45,000	4,950.0
Targhee	1994	900	1,300	182.0	0	0	0.0	2,100	3,800	418.0
	1993	1,300	2,500	355.0	0	0	0.0	12,500	21,600	2,376.0
Other Lands	1994	0	0	0.0	3,900	1,000	190.0	11,800	12,600	1,386.0
	1993	0	0	0.0	0	0	0.0	0	0	0.0
South Idaho Totals	1994	35,300	44,000	6,160.0	2,400	4,400	836.0	48,500	61,100	6,721.0
	1993	80,200	89,900	12,765.8	32,900	67,200	12,768.0	95,500	146,200	16,082.0
State Totals	**1994**	**37,785**	**51,363**	**8,737.0**	**9,463**	**12,241**	**2,404.2**	**51,382**	**65,792**	**7,235.1**
	1993	82,344	97,121	15,293.1	39,350	76,662	14,660.4	100,585	150,893	16,598.2

RED TURPENTINE BEETLE

Monitoring for red turpentine beetle attacks in recently pruned western white pine plantations continued in 1994. New sites were evaluated on the Fernan RD, Sandpoint RD, and Bonners Ferry RD, IPNF's. In nine sites surveyed, beetle attacks ranged from 1-33% on trees averaging 1.9-5.6 inches dbh. No mortality was noted. We have found that trees can be attacked within days of pruning and remain attractive to beetles up to 2 years later. The time of year trees are pruned does not appear to make any difference in level of attack. Red turpentine beetle adults are found flying throughout the spring, summer, and fall. The highest tree mortality (10%) due to the red turpentine beetle has been on the Palouse RD of the Clearwater NF. Little or no mortality has occurred elsewhere. For more detailed information, see Summary of Insect and Disease Projects (pg.31).

DEFOLIATORS

DOUGLAS-FIR TUSSOCK MOTH

There continues to be no defoliation due to the Douglas-fir Tussock moth in the forested areas of northern Idaho (Table 6, Figure 5), and only one moth was caught this year in pheromone trapping detection surveys near Spring Valley Reservoir. No larvae were detected in lower crown beating samples. The number of homeowners reporting larvae or defoliation of ornamental spruce was also lower than last year. All indicators show that Douglas-fir tussock moth population levels are extremely low and damage from these insects is unlikely in 1995.

During 1993, Douglas-fir tussock moth populations collapsed and no current defoliation was observed in all of southern Idaho (Table 5a, Figure 6).

RUSTY TUSSOCK MOTH

There were no reports of outbreak populations of rusty tussock moth in 1994.

WESTERN SPRUCE BUDWORM

In northern Idaho, defoliation on the Nez Perce NF continued to decline with zero acres detected in 1994 down from 730 acres in 1993 (Table 5b, Figure 4). Only two adult moths were caught on 16 sites. The summer of 1993 was abnormally cool and wet and populations declined dramatically. Populations are expected to remain low in 1995.

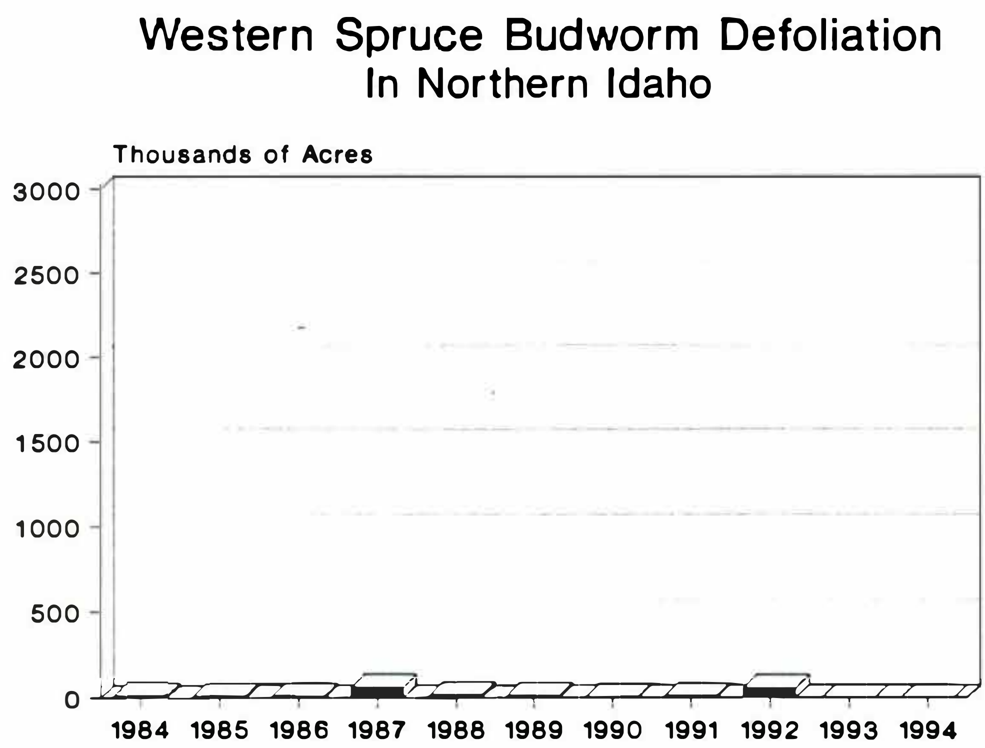
For the first time since the early 1960's, no visible defoliation from western spruce budworm was observed anywhere in southern Idaho (Table 5b, Figure 4).

Table 5a. Acres of **DOUGLAS-FIR TUSSOCK MOTH** defoliation as determined by aerial surveys

		Defoliation Intensity				
Forest and Adjacent Lands	Year	Light	Moderate	Heavy	Total	Change
Boise	1994	0	0	0	0	
	1993	0	0	0	0	
Payette	1994	0	0	0	0	
	1993	0	0	0	0	
Sawtooth	1994	0	0	0	0	
	1993	0	0	0	0	
Owyhee Mtns.	1994	0	0	0	0	
	1993	0	0	0	0	
Total	1994	**0**	**0**	**0**	**0**	**0**
	1993	0	0	0	0	

Table 5b. Acres of **WESTERN SPRUCE BUDWORM** defoliation as determined by aerial surveys.

		Defoliation Intensity				
Forest and Adjacent Lands	Year	Light	Moderate	Heavy	Total	Change
Challis	1994	0	0	0	0	**-225**
	1993	225	0	0	225	
Nez Perce	1994	0	0	0	0	**-729**
	1993	729	0	0	729	
Salmon	1994	0	0	0	0	**0**
	1993	0	0	0	0	
Targhee	1994	0	0	0	0	**0**
	1993	0	0	0	0	
Total	1994	**0**	**0**	**0**	**0**	**-954**
	1993	954	0	0	954	



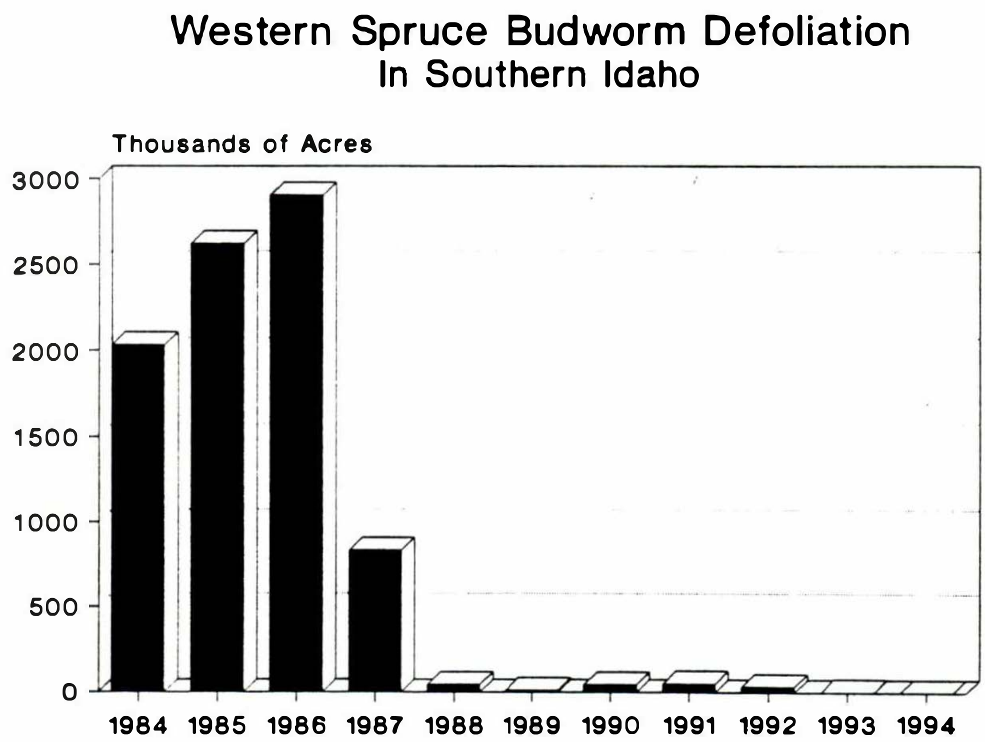


Figure 4. Acres of Western Spruce Budworm defoliation as determined by Aerial Surveys in Northern and Southern Idaho 1984 - 1994

Douglas-Fir Tussock Moth

Table 6. Means of average moth catch per 5 pheromone trap/sample plots in Idaho, 1994-1984

AREA	Number of 1994 sample plots	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984
STATE AND PRIVATE												
Coeur d'Alene	5	0.0	0.0	0.1	0.0	*	*	*	*	*	*	*
Coeur d'Alene	5	0.0	0.0	0.1	0.1	7.2	0.0	0.0	0.2	8.1	9.2	4.7
Plummer-Moscow	13	0.0	0.0	0.7	0.1	0.1	0.0	0.1	1.3	25.6	59.9	18.8
Plummer-Moscow	17	0.1	0.0	0.5	0.1	0.1	0.0	0.0	0.3	15.2	43.3	7.0
Plummer-Moscow	8	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.5	14.6	32.6	9.0
Plummer-Moscow	1	0.0	0.0	4.0	0.0	0.0	0.0	0.0	1.0	42.8	68.4	36.4
Plummer-Moscow	2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	3.8	49.7	76.0	*
Plummer-Moscow	3	0.0	0.0	1.6	0.1	0.1	0.0	0.2	9.0	80.5	*	*
Plummer-Moscow	14	0.0	0.0	0.1	0.1	0.2	0.0	0.1	2.2	*	*	*
Craig Mountain	8	0.0	0.05	0.5	0.0	0.2	0.0	0.0	0.1	3.5	0.4	0.6
NEZ PERCE NF												
Selway RD	5	0.0	0.04	0.1	0.0	0.4	0.1	0.2	0.0	0.1	0.0	0.1
Salmon River RD	5	0.0	0.08	0.7	2.5	0.1	0.0	0.0	0.0	0.9	0.3	0.7
CLEARWATER NF												
Lochsa RD	2	0.0	0.1	0.2	1.2	0.0	0.2	0.0	0.0	0.3	0.0	0.0
Canyon RD	5	0.0	0.0	0.1	0.3	0.2	0.0	0.0	0.0	1.7	0.9	*
Pierce RD	5	0.0	0.16	0.3	0.6	0.3	0.0	0.1	0.1	4.0	0.6	0.1
BOISE NF												
Mountain Home RD	2	0.1	0.0	32.2	68.9	5.3	0.2	0.6	1.4	1.2	0.0	0.4
Boise RD	*	*	0.0	23.5	59.6	65.6	*	*	*	*	*	*
Idaho City RD	4	0.0	0.0	0.6	27.2	*	*	*	*	*	*	*
Cascade RD	5	0.0	0.0	0.4	0.7	31.6	0.0	0.2	0.2	1.2	1.0	0.0
Lowman RD	11	0.0	0.0	1.8	20.0	*	*	*	*	*	*	*
Emmett RD	10	0.0	0.02	1.2	19.7	*	*	*	*	*	*	*
PAYETTE NF												
Council RD	11	0.0	0.0	2.8	6.6	23.2	0.7	1.9	7.4	21.2	5.1	6.7
Weiser RD	11	0.1	0.0	2.4	21.4	67.0	0.8	0.7	5.2	15.2	4.1	8.1
New Meadows RD	12	0.0	0.0	1.6	8.8	*	*	*	*	*	*	*
McCall Rd	5	0.0	0.0	0.8	0.7	*	*	*	*	*	*	*
SALMON NF												
Northfork RD	*	*	*	*	*	0.4	0.6	21.3	2.9	6.6	*	1.9
SAWTOOTH NF												
Fairfield RD	5	0.3	0.0	35.3	70.5	80.3	16.5	3.3	13.3	19.7	0.0	6.3
OTHER												
Owyhee Mountains	3	2.0	0.0	51.1	76.1	75.5	12.8	15.8	7.8	9.4	0.6	10.8
Sharps Canyon	1	0.0	0.0	18.8	*	53.2	9.2	36.4	8.4	22.6	5.2	1.3
Pine Rdg-Lost Lake	1	0.0	0.0	5.0	25.0	*	*	*	*	*	*	*

DOUGLAS-FIR TUSSOCK MOTH
PHEROMONE TRAP CATCHES IN NORTHERN IDAHO

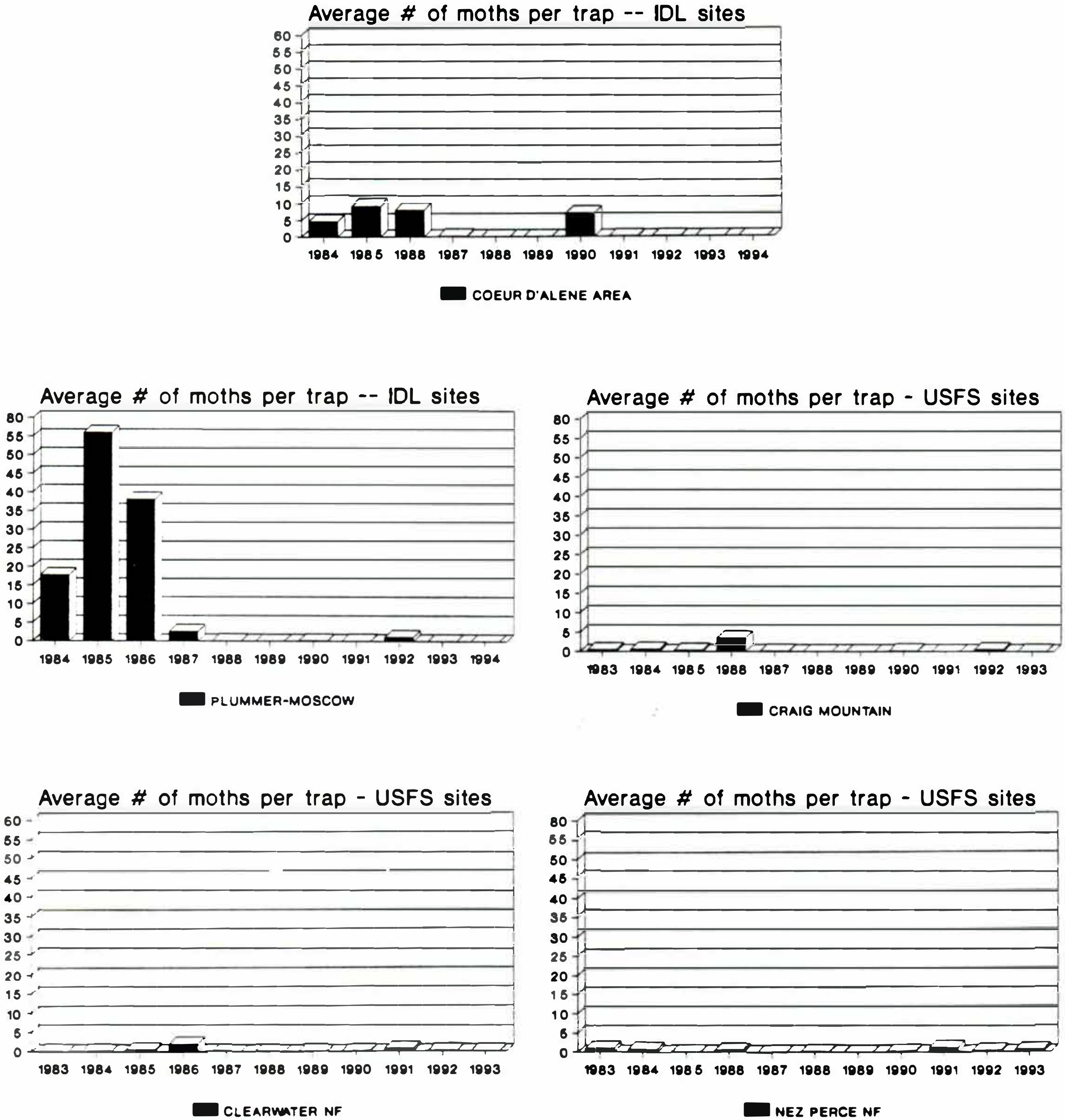


Figure 5. USFS and IDL
Douglas-fir Tussock Moth Trap Catches
in Northern Idaho 1984 - 1994

DOUGLAS-FIR TUSSOCK MOTH
PHEROMONE TRAP CATCHES IN SOUTHERN IDAHO

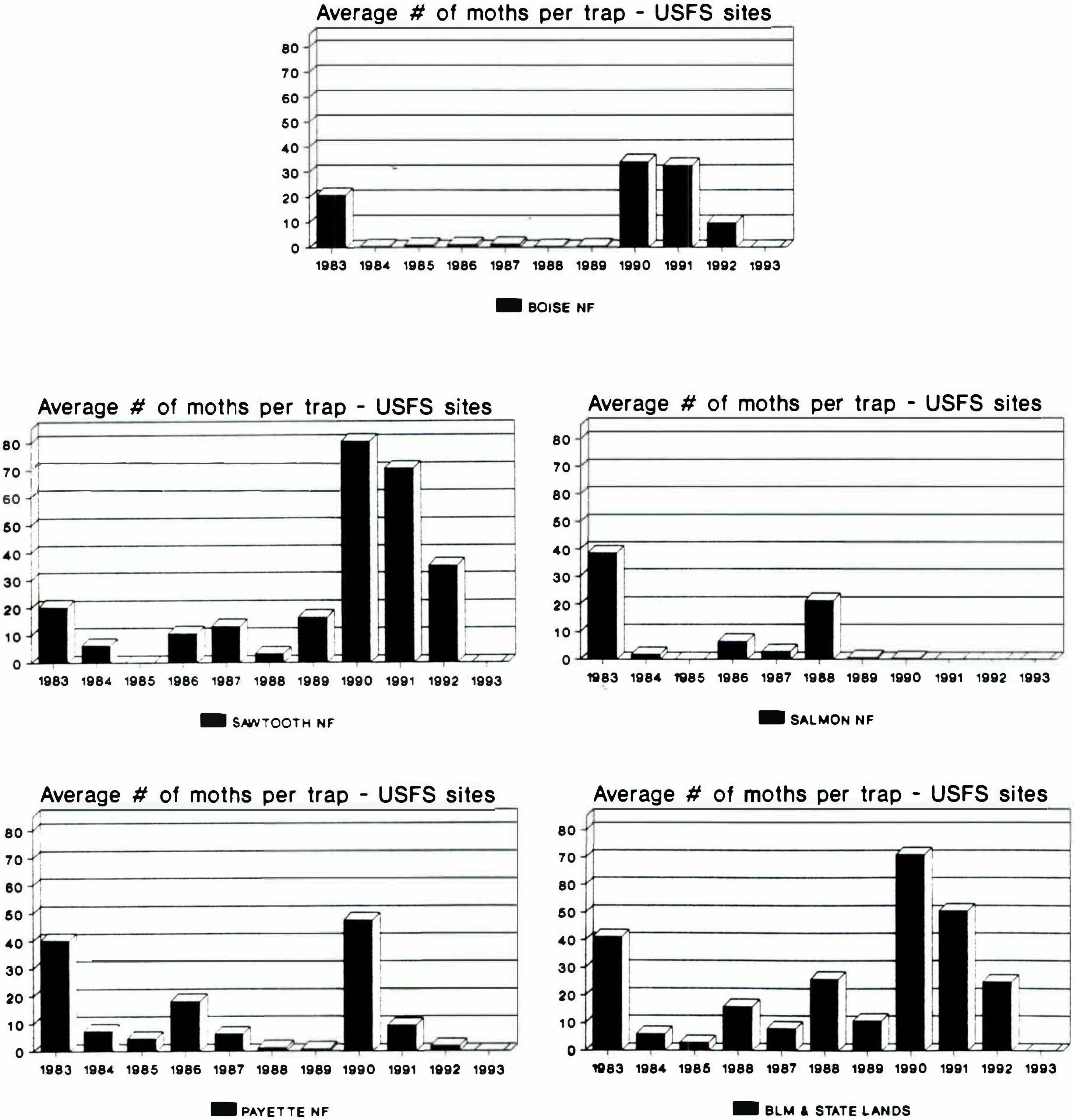


Figure 6. USFS
Douglas-fir Tussock Moth Trap Catches
in Southern Idaho 1984 -1994

GYPSY MOTH

The Idaho gypsy moth detection survey program systematically samples all populated areas of the state in order to detect introductions of gypsy moths. Many US Forest Service campgrounds are also sampled, as well as rest stops, tourist attraction sites and other locations where people congregate. High risk areas, those cities with the highest populations and the highest potential for newly arriving families, are trapped each year. Other areas are trapped every other year or every third year. A total of three moths were caught, and 4335 traps were placed throughout Idaho in 1994. The survey will continue to expand as the rural/urban interface develops and more people move into the rural areas of the state.

Detection trapping: The Idaho Department of Lands, the Idaho Department of Agriculture and the U.S. Forest Service Regions 1 and 4, with participation from APHIS, cooperatively placed 4239 pheromone baited detection traps throughout the state in 1994. Our target density for these detection traps is 4 traps per square mile. Added emphasis is given to cities, towns and rural areas when a sufficient number of new families move in to generate an increased risk of introducing gypsy moths. Tracking of these new "move-ins" is provided in a report compiled by the Idaho Department of Transportation showing the locations of people moving to Idaho from gypsy moth infested states. The report is derived from applications for vehicle title transfer. It shows that approximately 250 individuals or families move to Idaho each month from the generally infested states of the Northeast, including Virginia, West Virginia and Wisconsin.

Only one of the moths was caught in a detection trap in 1994 (Figure 7). This moth was caught in Pocatello, Bannock Co. This area will be intensively trapped in 1995.

Delimitation trapping: Detection trapping was done at two sites in 1994, Coeur d'Alene, and Pocatello. In the city of Coeur d'Alene, 94 traps were placed in the area where two gypsy moths were caught last year. The two moths caught in Coeur d' Alene (Figure 7) this year were caught in these delimiting traps. Two delimitation traps were also placed in Pocatello near where the single moth was caught in the detection trap.

State advisory committee: An advisory committee, composed of representatives from the above mentioned agencies and the University of Idaho, provides guidelines for the gypsy moth program in Idaho.

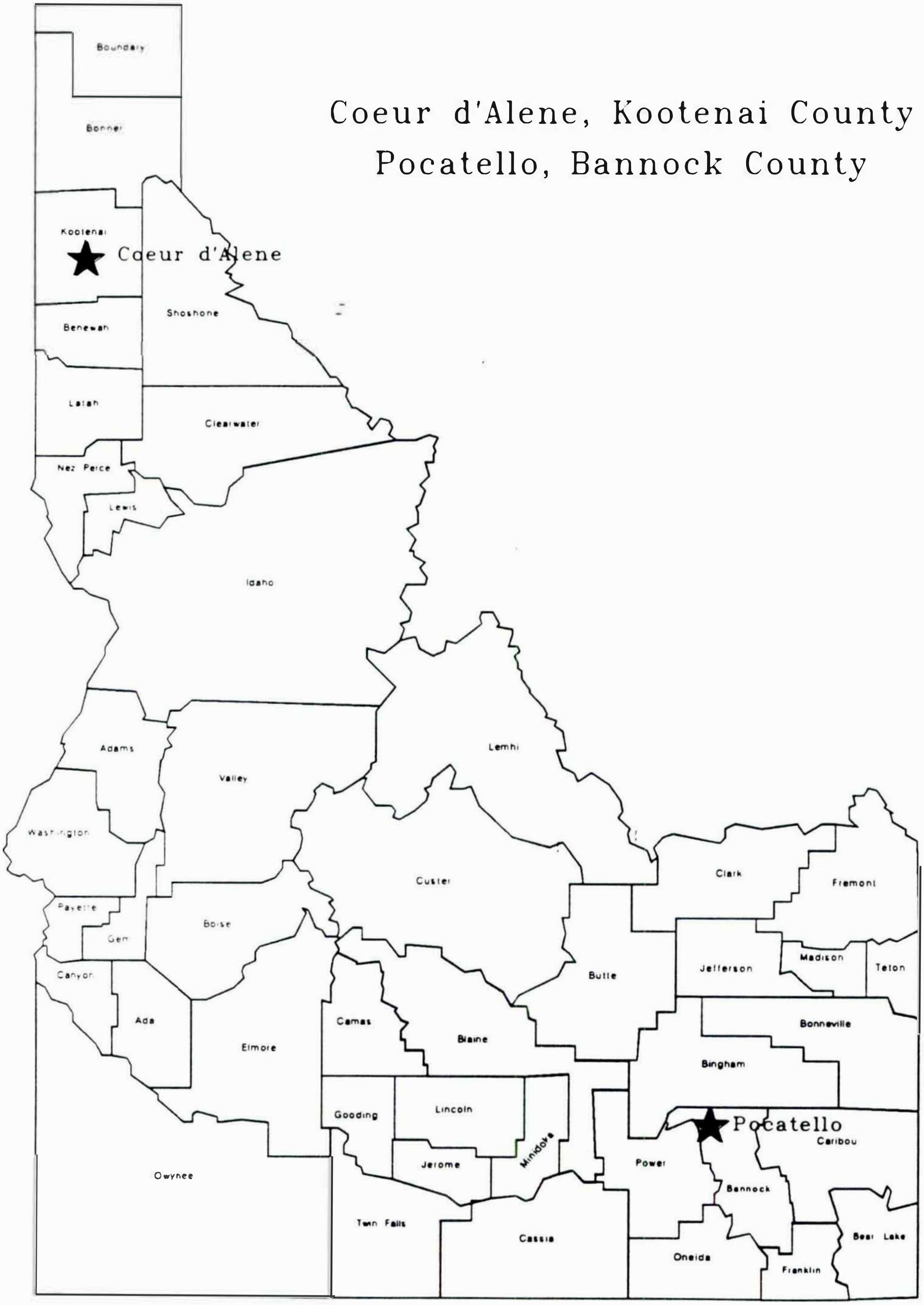


Figure 7. State of Idaho
1994 Gypsy Moth Catch Sites

OTHER INSECTS

BALSAM WOOLLY ADELGID

Balsam woolly adelgid populations are continuing to increase in northern Idaho. This trend has been developing since the winter of 1990/91 when adverse weather conditions caused the population to crash. Reduced population levels were only seen in 1991. Since then populations have continued to increase with infestation showing up in new locations each year, with the number of killed trees growing ever higher. The low elevation frost pocket subalpine fir continues to suffer the highest mortality. In some of these areas nearly 100 % of this host has been killed.

A complete picture of the extent of the balsam woolly adelgid infestations was not obtained in 1994 from aerial survey, as visibility was very limited due to the record number of fires in the region. Extensive ground surveys are planned for 1995.

CRANBERRY GIRDLER MOTH

Cranberry Girdler moths were caught in pheromone traps at the Coeur d'Alene nursery from June 14 - Sept. 21. The highest trap catches occurred Sept. 6 when 343 moths were caught. However, another high count occurred on June 28 with 253 moths caught. These counts are much lower than the peak of 807 which occurred June 23, 1993. Trap catches in previous years have been highest during the end of June or early July. Nursery beds were sprayed once with dursban, aimed at larvae in the soil on September 7.

Damage assessment was done differently this year. An estimate of girdler moth damage out of all the discarded seedlings was done in the packing shed. Damage estimates ranged from 0-40% with an average of 2.7% in 90 lots. This was 2.7% of discarded seedlings, not of the whole lot, and was considered within acceptable limits. The spray regime was considered adequate to reduce potential damage.

CONE AND SEED INSECTS

The summer of 1994 was very warm and dry and evidently beneficial for seed bugs. Both adults and nymphs were abundant in all pine seed orchards examined and the adults were again a nuisance to people in the fall as they entered houses while seeking overwintering sites.

The Coeur d'Alene western white pine seed orchard was examined for cone and seed insects the first week in May, June, July, and August. Adelgids were the only insects observed in May. Seed bug adults were first observed in June and both adults and nymphs were abundant in early July. The orchard was sprayed with Pounce during the week of July 11. Spraying was completed with both a ground hydraulic sprayer and individual tree sprinklers (see Summary of Insect and Disease Projects pg. 32). Seed bug nymphs and adults were again abundant in early August. Immigration of seed bugs from outside the orchard has been a problem due to the abundant surrounding ponderosa pine. A fall treatment was recommended to protect conelets but could not be completed. Other insects observed in smaller numbers included coneworms and cone beetles. A total of 1035 bushels of cones were harvested yielding 398 pounds of seed (.38 lb/bu). This was a lower harvest and yield than 1993.

The Lone Mountain white pine orchard was only examined once in July due to technical difficulties with the lift truck. A small number of adelgids and a few seed bugs were observed. A record 1186 bushels of cones were harvested yielding 432.5 pounds of seed (.36 lb/bu). This was a huge increase in harvest from previous years.

The Grouse Creek white pine orchard was examined the first week in May, June, July, and August. Adelgids were observed in May. Light damage from coneworms and cone beetles was observed in early August as well as several seed bug nymphs. Treatment to protect cones from insect feeding may be necessary in future years. Pheromone traps

containing different test blends of coneworm pheromones were placed in the orchard in early May and collected in September. No coneworm adults were caught.

The Douglas-fir orchard at Dry Creek was examined once in June. Only a couple trees had cones. A moderate infestation of Cooley spruce gall adelgid was noted.

The BLM ponderosa pine seed orchard at Russell Bar on the Salmon River was examined in late April. At that time, numerous seed bug adults and cone beetle infested cones were observed. The Reduviidea predator that was so numerous last year was also abundant again in 1994. The orchard was sprayed in May to protect the cones from further damage by seed bugs and re-examined in early June. No seed bugs were seen during the second examination. An earlier spray will be necessary to control cone beetles next year.

The Moscow White Pine Seed Orchard, located on the University of Idaho campus in Moscow, Idaho, had an exceptionally good year in 1994. Monitoring efforts for the coneworm, *Dioryctria abietivorella,* and the lodgepole pine cone borer, *Eucosma rescissoriana,* began on April 5, 1994. The coneworm has caused considerable damage to the cones and seeds in previous years. Since there are no known pheromones for the coneworm, *Eucosma* baited pheromone traps were placed throughout the orchard to serve as indicators of emergence. Traditionally, the emergence of *Eucosma* has served as the indicator of biological activity, with a spray treatments being timed to come closely after the emergence of the *Eucosma.* The first moth was caught on April 14, with peak flight occurring on April 24, one week earlier than in 1993. The orchard was sprayed with Pounce ®(permethrin) to control the coneworm on May 5, 1994. Pounce was used this year rather than Asana XL® (esfenvalerate) in order to avoid possible build up of scales insects and to avoid the potential for development of resistance. The treatment appeared to be very effective as there was virtually no visible cone damage noticed at harvest time.

The western conifer seed bug has also been a continual threat to this seed orchard. Monitoring for this pest has always been a challenge as their are no known trapping methods, attractants, or any other survey methods other than visual searching. We have searched using 10X binoculars and a high power telescope. This is a time consuming technique, but when the bugs are present, they can be found. A more positive way of detecting this pest has been to have those workers who are picking cones watch for them. We have timed treatments by finding the insect using both of these methods. The first bugs were seen in late July with more being seen during the process of picking the cones. The orchard was treated with Asana as soon as the pickers were finished for the year, on August 18,1994. This mid-summer treatment protects next years cones from the seed bugs. In a break from tradition, this spraying was done by fixed wing aircraft rather than by helicopter. Arranging for a helicopter has always been a challenge as this is usually a very busy time of year for the limited helicopter services available. Inquiries were made and a company was found that indicated they could use a fixed wing aircraft to do the job. From all observations they accomplished the treatment in an accurate and effective manner.

In 1994, the seed crop was the best it has ever been, with a record 2620 bushels of cones being collected. There was almost no observable insect-caused damage seen on the cones as they were picked. Jerry Franc, of Northwest Management Inc. , Moscow, ID conducted the surveys and coordinated the treatments.

TIP MOTHS

The ponderosa pine plantation at the Lenore Tree Improvement Area, Clearwater NF was treated with a mating disruption technique for protection from ponderosa pine tip moth damage in 1994. Tip moth larvae infest shoots of young pine trees resulting in terminal growth loss and stem deformities. On February 22, 176 releasers were placed in the plantation approximately 10 meters apart. Ten pheromone traps were also placed in the plantation. Theoretically, if mating disruption is successful, very few moths should be caught in the traps.

During the post treatment assessment, only 1 terminal and 42 laterals were infested on 1,623 trees examined and only 1 moth was caught in the traps. Compared to the post-spray assessment in 1993 where 24 terminals and 148 laterals were infested, and the 1992 pre-treatment assessment of 111 terminals and 162 laterals damaged, the mating disruption treatment was a success.

FOREST DISEASES

This narrative is divided into two sections. The first section describes diseases or disease problems which are known to have changed during 1994. Our most severe disease problems continue to cause widespread damage over much of the same areas every year.

The second section is a table which summarizes disease problems observed in 1994 with brief remarks describing hosts, location and severity.

STEM AND BRANCH DISEASES

DWARF MISTLETOES

Dwarf mistletoes are widespread throughout forests in Idaho. In southern Idaho dwarf mistletoes infect 45% of the lodgepole pine stands, 33% of Douglas-fir stands and 25% of ponderosa pine stands. Dwarf mistletoes are not aggressive tree killers but can have a serious impact due to growth reduction.

Estimates for dwarf mistletoe indicate over 700,000 acres are infested with volume losses of over 13 million cubic feet. Dwarf mistletoe management considerations are generally included in Forest plans, and emphasize management through conventional forest management practices. However, there are still some previously harvested stands that qualify for sanitation treatment to eliminate residual infested trees that threaten the regeneration.

ROOT DISEASES

Rough estimates indicate that root disease mortality occurs on nearly 2 million acres of Idaho forests, causing losses of over 30 million cubic feet. Root diseases continue to be the primary disease concern throughout northern Idaho forests and are the subject of several studies. Please refer to the project summaries in the following pages for the current status of these projects.

VASCULAR WILTS

The City of Boise removed about 52 American elm trees that were infected with Dutch Elm disease from city property or right-of-way areas in 1994. About 1,300 elms remain out of the nearly 5,000 elm trees in the city 20-years ago when the disease was first diagnosed in Idaho. While elms comprise less than 8 per cent of the total trees of the Boise urban forest, their care, primarily because of spraying for elm leaf beetle, demands more than 25 per cent of the maintenance budget. Consequently, elms are not permitted for right-of-way plantings in the city.

Dutch Elm disease continues to maintain a foothold in Moscow Idaho where a total of seven infected American elms were removed this year. Trees in one city park are continuing to be injected with fungicides to prevent further losses. However, Pullman, Washington (8 miles to the west) has no program and continues to loose American elms at a rapid rate.

FOLIAGE DISEASES

Each year several different fungi attack the foliage of several different conifers to varying degrees depending on weather conditions the prior year when infections took place. Although several different needle disease fungi are involved, the symptoms are similar, as last years' foliage turns red early in the spring before the new foliage emerges. However, by mid-July, many of the infected needles have dropped and the new green growth makes the trees look much healthier. Most needle disease fungi only attack a single age-group of needles, but successive years of infection may leave trees with only the current years' needles. This often gives branches a "lion-tailed" appearance, and may result in reduced growth rates.

Lodgepole pine needle cast continues to be widespread throughout the range of lodgepole pine in Idaho although infection levels in southern Idaho forests dropped considerably from record levels reported last year. However, lodgepole pine needle casts had another heyday in northern Idaho forests in 1994. High elevation lodgepole pine stands along the Idaho-Montana border were especially hard hit for the fourth consecutive year. Even though many trees appeared to be "on their last leg", surveys found very little mortality. Surveys will be continued in 1995.

The primary needle cast of ponderosa pine is Elytroderma which is widespread throughout the ponderosa pine forest in Idaho. Areas of chronic severe infection occur around Cascade and Council, Idaho. Elytroderma was much more widespread in north Idaho and Montana this year. Diplodia blight of ponderosa pine continues to cause widespread dieback of foliage and small branches throughout much of northern Idaho. Chronic areas with high levels of infection are along the Clearwater river, but infection intensities vary widely from tree to tree in any particular location.

In north Idaho many sites that burned in the early 1900's have been regenerated with off-site ponderosa pine. These stands are now suffering severe mortality from a combination of foliage diseases, root diseases and secondary bark beetles.

Discoloration of young white pine due to needle casts in the Priest Lake area of north Idaho also generated considerable public concern, until the new growth made them look green again.

In stark contrast to the pine needle casts, larch needle casts were at very low levels in 1994. Meria needle cast in southern Idaho was at least partly confounded by a late frost which killed much of the early growth in higher elevations.

DISEASES OF NURSERIES AND TREE IMPROVEMENT AREAS

1. Cuttings of Pacific Yew being produced at the USDA Forest Service Nursery in Coeur d'Alene were infected with several fungi eliciting necrotic lesions on foliage. The most common foliar inhabitants were sooty molds of the genus Capnodium. These fungi caused reduced rooting of cuttings.

2. Chokecherry seedlings from a private nursery in Lakefork, Idaho were infected with a fungus inducing shot-hole symptoms on leaves. This fungus was identified as Phloeosporella padi.

3. Drought injury was common on trees from many plantations in northern Idaho during 1994. An example includes corkbark fir for Christmas trees in plantations near Sandpoint.

COMMON AND RECURRING NURSERY DISEASES

1. The most common and damaging diseases of conifer seedlings in Idaho and Montana nurseries continued to be root diseases caused by Fusarium spp. These fungi caused damping-off and root diseases on many different conifer hosts in bareroot and container nurseries. The most common soil-borne pathogen in bareroot nurseries was F. oxysporum, although several other species were commonly isolated from infested soil and roots of diseased seedlings. The major pathogen in container nurseries was F. proliferatum, although F. oxysporum and several other fusaria also occurred at high levels in some nurseries. Fusarium diseases in nurseries were often very difficult to control. Although all conifer species were susceptible, most damage occurred on Douglas-fir, western larch, western white pine, and Engelmann spruce.

2. Cylindrocarpon destructans continued to cause severe losses to western white pine and whitebark pine seedlings at several nurseries. Although damage to other conifer species occurred, root decay of five-needle pines was most serious. Most efforts to reduce amounts of root decay have been unsuccessful.

3. Botrytis cinerea continued to cause damage to container-grown western larch and Engelmann spruce seedlings at several nurseries. Western red cedar was also been shown to be very susceptible to this pathogen. Conifer seedlings stored for prolonged periods of time may become severely damaged by B. cinerea, particularly if storage temperatures are maintained above freezing.

4. Tip dieback caused by Sirococcus strobilinus, Sphaeropsis sapinea, and Phoma eupyrena commonly occurred at low levels at most bareroot nurseries. Ponderosa and lodgepole pine were the two most affected species.

5. Pythium root disease usually occurred at low levels at most bareroot nurseries. The most important causal organism was P. ultimum. Damage can be reduced by improving water drainage in soil.

STATUS OF CHRONIC DISEASE PROBLEMS		
DISEASE	**HOST**	**LOCATION/REMARKS**
STEM & BRANCH DISEASES		
Aspen trunk rot	Aspen	Especially common in older aspen stands in southern Idaho
Atropellis canker	Lodgepole pine	Found in pockets in pole sized stands causing defect, topkill, and some mortality.
Comandra blister rust	Lodgepole pine/ponderosa pine	Most common in SE Idaho; infrequent but may be locally severe.
Cytospora canker	True firs	Increased levels of symptoms, considerable branch flagging, and top-killing in localized areas. Frequently associated with western balsam bark beetle in southern Idaho.
Diplodia blight (Sphaeropsis blight)	Ponderosa pine	Is causing widespread branch dieback in many Idaho areas; especially common in riparian areas.
Dwarf mistletoes	Douglas-fir, western larch, lodgepole and ponderosa pine	Widespread and damaging throughout the state.
Indian paint fungus (Rusty-red stringy rot)	True firs, hemlock	Causes 90 per cent of decay in these species throughout the state; especially common as age increases beyond 60 years.
Red ring rot	Western larch, true firs, Douglas-fir, pines, spruce	Can cause serious decay problems in mature conifers.
Stalactiform blister rust	Lodgepole pine	Heavy infection has been observed in localized areas of the Boise, Payette, Sawtooth, and Targhee NF's.
Western gall rust	Lodgepole and ponderosa pine	Occurs throughout the host range; with localized areas of heavy infection.
White pine blister rust	Western white pine, limber pine, whitebark pine	Continues to be a major mortality factor in natural regeneration; becoming a major problem in subalpine pines.

ROOT DISEASES		
Annosus root disease	Pines, true firs, Douglas-fir, spruce	Causes mortality, root and butt rot especially in young trees near old stumps; frequently in complexes with other root diseases; may predispose trees to windthrow and/or bark beetles.
Armillaria root disease	Douglas-fir, grand fir, other conifers especially when young and improperly planted	In north Idaho, a widespread killer of all sizes of trees; a weak pathogen or in complexes in southern Idaho.
Black stain root disease	Pines, Douglas-fir	Found infrequently in Idaho; caused pinyon pine mortality in southern Idaho; usually in association with other root diseases.
Laminated root rot	Douglas-fir, true firs, occasionally other conifers	Primary killer in many stands from the Nez Perce NF north; may be found with Armillaria or other root diseases.
Schweinitizii root rot	Douglas-fir, pines	Common in mature and overmature forests throughout the state; frequently associated with other root diseases and bark beetles.
Tomentosus root disease	Douglas-fir, subalpine fir, Engelmann spruce, lodgepole pine	Usually found as root/butt rot with other root diseases; occasionally causes mortality. Most common in southern Idaho, but present throughout the state.
FOLIAGE DISEASES		
Conifer-Aspen rust Conifer-Cottonwood rust	Aspen, cottonwood, conifers	Commonly observed on hardwood hosts in southern Idaho; some clones were severely defoliated.
Rhabdocline needlecast	Douglas-fir	Very widespread but relatively light levels statewide.
Swiss needlecast	Douglas-fir	Widespread in north Idaho; generally at very low levels of infection.
Elytroderma needlecast	Ponderosa pine	Widespread throughout the state but more prevalent in drier climates; increased dramatically in 1994 in northern Idaho.
Fir broom rust	True firs	Widespread throughout the state; usually of little consequence, but is pandemic in stands south of the Snake River in southern Idaho.
Fir needlecast	Subalpine fir Grand fir	Infection occurred at low levels throughout the host type.

Fir needle rust	Subalpine fir	Variable infection levels on young trees throughout host type.
Larch needlecast & blight	Larch	Both diseases occur throughout Idaho. In Northern Idaho infection levels were very low in 1994.
Lodgepole pine needlecast	Lodgepole pine	Widespread throughout Idaho; infection levels increased dramatically in 1994.
Marssonina blight Shepard's Crook	Aspen	Scattered incidence of light to heavy intensity throughout most of host range.
Pine needle rust	pines	Scattered incidence of light to moderate intensity scattered throughout the host types in southern Idaho.
Spruce broom rust	Engelmann spruce	Scattered through host range; most common in eastern Idaho.
White pine needlecast	Western white pine	Severe infections of lower crowns throughout north Idaho, especially near moist drainages.
NURSERY DISEASES		
Cylindrocarpon	Western white pine whitebark pine	Common in soil or contaminated containers, usually a saprophyte but may be a weak parasite, caused losses at several nurseries.
Diplodia tip blight	pines	Low levels in areas with a history of problems.
Fusarium root disease	Douglas-fir, larch, spruce, others	The most common and widespread nursery disease; amount of damage varies widely.
Grey mold	most conifers, esp. larch, spruce,	Common at low levels in many nurseries. Can be a serious storage problem.
Meria needlecast	larch	Infections levels were very low in 1994.
Phoma blight	pines	Commonly isolated from seedlings and soil samples.
Sirococcus tip blight	spruce, pines	Found at low levels at several nurseries.

SUMMARY OF DISEASE AND INSECT PROJECTS

WHITEBARK PINE CONE AND SEED INSECT SURVEY (Kegley/Campbell) A survey of insects affecting whitebark pine cones and seeds was initiated in 1994. A total of 32 whitebark pine sites were visited. Of these, 24 had trees that we could potentially climb and collect cones but only 3 sites had second-year cones to collect. Cones at these sites were collected and examined for insect damage. Cones collected by the St. Maries district at one other site were also examined for insect damage. External evidence (frass or boring dust) and/or larvae of a coneworm, Dioryctria sp. were found in a high percentage of the cones examined.

Location	# cones examined	% with coneworm damage
Gisborne Mtn.	296	67
Schweitzer	50	48
Big Mtn.	7	100
Freezeout Ridge	201	75

The cones have been placed in rearing cages and any adults that emerge will be identified to species. Other, less conspicuous insects may also be discovered through rearing and dissection. This was a poor cone crop year and insect infestations may be abnormally high due to the few cones available for colonization. However, our preliminary survey showed that insects are infesting whitebark pine and may have a high impact on viable seed. This project will continue for the next few years to get a damage assessment of cone crops of various sizes and determine impact.

CONE AND SEED INSECT CONTROL PROJECT (Livingston) Assistance has been provided to Forest Management Services of Moscow, ID in monitoring for and treating cone and seed insects at the western white pine blister-rust resistant plantation at Moscow, Idaho. A record number of bushels of seed were collected in 1994.

EVALUATION OF THE FLIGHT PERIOD OF THE WESTERN BALSAM BARK BEETLE. (Kegley, Gibson, Oakes, Randall). Pheromone baited Lindgren Funnel Traps® were placed in the Trout Creek drainage of the Bonners Ferry RD, IPNF's and on the Bitterroot NF once again to monitor the flight period of the western balsam bark beetle. Trap catches were much lower this year than in 1993. At Trout Creek, beetles were caught from June 24 through Sept. 23. Peak trap catch occurred on July 1. The cool, wet summer of 1993 may have caused a decline in the population reflected in the 1994 trap catches. The summer of 1994 was unusually hot and dry. Because we have monitored the western balsam bark beetle flight period during two summers of abnormal weather, the traps will be monitored once again in 1995.

EVALUATION OF THE FLIGHT PATTERNS OF THE PINE ENGRAVER AND DOUGLAS-FIR BEETLE (Livingston) Information is being gathered on the flight patterns of the pine engraver and Douglas-fir beetle through the use of pheromone-baited Lindgren Funnel Traps®. Trap catch information will be correlated with temperature and precipitation data. The results of this effort will provide additional understanding of flight patterns, duration of flight, initiation of flight in relation to spring temperatures, the number of generations of beetles, behavioral activity, and the influence of weather patterns on these insects.

RED TURPENTINE BEETLE DAMAGE IN PRUNED AND EXCISED WHITE PINE. (Schwandt/Kegley). Monitoring for red turpentine beetle (RTB) attacks in recently pruned western white pine plantations continued in 1994. New sites were evaluated on the Fernan RD, Sandpoint RD, and Bonners Ferry RD, IPNF's. Although beetle attacks were as high as 33% in one area, no mortality due to the beetle was found (Table 7).

Table 7. Plantations surveyed in 1994 for RTB attack.

Year Pruned	Stand	# Trees Sampled	Ave. DBH	% RTB Attack	% Tree Mortality
1994	Fernan-Skitwish 1	100	3.2	33	0
1994	Fernan-Skitwish 2	100	2.9	10	0
1994	Fernan-Skitwish 2a	100	2.5	17	0
1992	Snpt-Trestle R. 1	100	1.9	20	0
1992	Snpt-Trestle R. 1a	100	2.2	21	0
1992	Snpt-Trestle R. 2	100	5.6	13	0
1993	Bonners-Mission Cr.	100	2.7	27	0
1993	Bonners-Dawson Cr	100	3.1	1	0
1992	Bonners-Placer Cr.	100	2.7	2	0

In order to determine how long the RTB will attack pruned western white pine, we tagged trees at Lamb Creek, Clearwater NF in 1992. We purposely tagged trees that were currently attacked at that time but were still alive. In 1993, 19% of the trees had died and 32% had new beetle attacks. In 1994, we saw only 2% current mortality, and 2% of the trees had new beetle attacks. We found that trees can be attacked within days of pruning, and remain attractive to beetles for up to two years. The time of year pruned does not appear to make any difference in level of attack by the RTB.

In our study of severely pruned trees (pruned to the top whorl) verses normally pruned trees (50 percent of crown pruned), twice as many severely pruned trees were attacked and 4.5 times as many died due to beetle girdling. This indicates that severe pruning may not be beneficial, especially in trees taller than 10 feet.

TREE NUTRITION AND ARMILLARIA ROOT DISEASE (Schwandt)

The relationship between tree nutrition and resistance to root disease is the subject of a study with the Intermountain Forest Tree Nutrition Cooperative initiated near Orofino in 1989. Armillaria root disease seems to prefer conditions with high sugar concentrations and is impeded by high phenolics which are considered important defense mechanism in plants. This study was initiated to see if potassium or nitrogen fertilizer applications could influence these concentrations and have an impact on root disease.

Five years after applying different combinations of nitrogen and potassium fertilizers to a thirty year old Douglas-fir stand with root disease, analysis of root samples found a significant reduction in root sugar concentrations accompanied by increases in root phenolic concentrations. The resulting phenolic: sugar ratios on fertilized plots were significantly higher than the controls, and the plots treated with potassium had higher ratios than those receiving nitrogen only.

Five to nine percent mortality due to root disease has occurred on nearly all treatments, but the numbers are too small and inconsistent to indicate any significant treatment differences. Additional trees are showing root disease symptoms on nearly all plots, and although the control plots have had the greatest increase in new infections (from 2 to 10 trees), the numbers are too small to be statistically significant at this time.

These plots will continue to be monitored to see if these results change over time. In 1994, the Nutrition Cooperative installed another set of plots in the Idaho Panhandle NF to act as another replicate of this experiment.

VERBENONE AND IPSENOL AS ANTI-AGGREGANTS OF PINE ENGRAVER. (Livingston/Gibson)

This is part of a continuing effort to develop a technique, using insect pheromones, of preventing attacks by pine engravers in slash that is available for the spring flight of beetles. Prevention of these attacks would limit population build up and

provide a degree of protection for standing leave trees. The availability of this technique would allow spring harvesting and thinning in stands of ponderosa and lodgepole pine. Tests were conducted by treating hand created piles of slash with pairs of bubble caps containing verbenone or Ipsenol. Comparisons were made by counting beetle attacks of piles treated with 5, 10, or 15 pairs of the bubble caps, and with untreated check piles. The treatments were duplicated, one set in Idaho and one in Montana. The Idaho test did not show a treatment effect, while in Montana, there was a distinct pattern with the highest number of pheromone pairs showing the best treatment results. Because treatment effect was not as pronounced as we had hoped, we plan to repeat the test in 1995 using an array of additional semiochemicals. The 1995 tests will be conducted by challenging attractant baited Lindgren funnel traps with various potential anti-aggregative compounds and mixtures of compounds.

EVALUATION OF INDIVIDUAL TREE CROWN SPRINKLER. (Kegley). Individual, semi-permanent tree sprinkler systems were installed on 10 trees at the Coeur d'Alene western white pine seed orchard as a possible alternative to hydraulic ground spraying for protecting cones from insect damage. The tree sprinklers consist of nozzles attached to the tree terminal and connected to tubing running down the bole to ground level. The tubing is then connected to a pump on the ground when treatment is necessary, and the desired amount of pesticide sprayed at the top of the trees where most of the cones are. Coverage was good on all trees except those with very wide crowns. Other types of nozzles will be tested in 1995. Efficacy data from this year's test is pending.

MOUNTAIN PINE BEETLE PERMANENT PLOTS. (Kegley, Oakes, Gibson, Randall). New permanent plots were installed on the Bonner's Ferry RD, IPNF's, and on the North Fork RD, Clearwater NF in lodgepole pine. We now have plots in 5 different areas in northern Idaho. These plots will help calibrate the Cole/McGregor mountain pine beetle rate of loss model for northern Idaho as well as provide data for validation of the new western pine beetle model. We hope to install additional plots on the Nez Perce NF in 1995.

WESTERN SPRUCE BUDWORM PERMANENT PLOTS. (Campbell/Kegley). Permanent plots on the Nez Perce NF were remeasured for defoliation and budworm population estimates. Additional plots were established near Squaw saddle during 1994. The area surrounding and including the plots had been defoliated for five years prior to 1994. Plots were also established in a shelterwood cut near the road junction of 243 and 221 near Whitebird. Site and tree data were collected on plots in both the cut and the uncut adjacent unit. All budworm permanent plots will be monitored annually for defoliation and over the long-term for budworm effects on ecosystem structure and function.

DOUGLAS-FIR TUSSOCK MOTH PERMANENT PLOTS. (Campbell/Kegley). Permanent plots on the Palouse RD, Clearwater NF were measured for defoliation and tussock moth population levels using pheromone traps. No moths were caught and no defoliation noted. This is a long-term project that will help calibrate/validate the DFTM extension of the FVS model.

DWARF MISTLETOE INFECTION OF YOUNG WESTERN LARCH. (Mathiasen) This study was begun in 1991 and continued in 1994. The objective is to determine the ages at which young western larch are initially infected by larch dwarf mistletoe. Young infected larch are being sampled and their age and height when first infected determined by aging all mistletoe infections on each tree. Several temporary plots are being established around mistletoe-infected seed trees. Infection of young regeneration near the seed trees will be monitored for several years to determine infection rates in the regeneration over time.

EFFECTS OF PRECOMMERCIAL THINNING IN MIXED CONIFER STANDS INFESTED WITH ARMILLARIA ROOT DISEASE. (Mathiasen) This project was started in 1993 and is a cooperative effort between the Idaho Department of Lands and the Intermountain Research Station. The primary objective of the study is to compare mortality rates of different tree species in ecologically similar, precommercially thinned and unthinned Armillaria-infested mixed conifer stands. Field data was collected from June-September, 1993 on Idaho state lands near Orofino, Idaho. A report summarizing the results from the field data was completed in 1994 and is available from the

Idaho Department of Lands. Other objectives of the study are to examine the biological species of Armillaria present in the study areas and determine the role of the various species in causing damage. This aspect of the study was begun in 1993 and is being continued by the Intermountain Research Station.

MONITORING OF FIELD PERFORMANCE OF BLISTER RUST-RESISTANT WESTERN WHITE PINE. (Mathiasen/Schwandt) This study is designed to monitor blister rust infection in F^1 and F^2 plantations operationally planted on state and federal lands, throughout north Idaho. Permanent plots established in plantations representing different levels of rust hazard will be revisited to document changes or trends in blister rust infection and pine mortality. Young plantations are being monitored because it is easier to distinguish between naturally regenerated and planted seedlings and to more accurately identify causes of mortality as it occurs.

Fourteen plantations on Idaho state lands and seven plantations on USFS lands have been surveyed thus far. All of the state plantations and five of the USFS plantations represent the F^2 generation of rust-resistant western white pine stock. However, it was discovered in 1993 that six of the fourteen IDL plantations accidently had wild stock planted among the rust-resistant stock. Since there is no practical means of distinguishing which trees are wild and which are rust-resistant, data from these six plantations can not be used to evaluate the performance of rust-resistant western white pine. The other stands will continue to be monitored on a regular basis.

FOREST HEALTH. (Hagle) Insect and pathogens are important disturbance agents which bring change to forests. The impact of natural disturbances such as insects and pathogens must be integrated into forest planning in order to responsibly develop management strategies.

I & D efforts are aimed at describing how insects and pathogens affect successional patterns and disturbances, describing and comparing current and historic insect and pathogen activity, and predicting future successional trends which reflect the role of insects and pathogens.

An effort is underway to package these steps into a fully automated system, so that future analyses to predict successional changes can be done more quickly.

NURSERY DISEASE PROJECTS (James)

1. Alternatives to chemical soil fumigation for control of soil-borne diseases in bareroot nurseries: This multi-regional project was initiated in 1993 in response to the proposed banning of methyl bromide as a soil fumigant by the year 2001. Treatments were established in the two Forest Service nurseries in Idaho (Coeur d'Alene and Lucky Peak - Boise) to evaluate efficacy of certain organic amendments and following to control soil-borne pathogens. Plots were sown with conifers in the spring of 1994 and data taken on disease incidence and first-year seedling performance. Tests will continue through the 1995 growing season and treatments are scheduled to be repeated within additional portions of the nurseries sown in 1995. Preliminary results indicated that some treatments seem more efficacious than others, although definitive conclusions cannot be made until tests are concluded.

Another portion of this project deals with genetic studies to ascertain pathogenic characteristics of the common soil-borne pathogen, Fusarium oxysporum. New molecular biology techniques (polymerase chain reaction, restriction fragment length polymorphisms), vegetation compatibility testing, isozyme analysis, and pathogenicity testing are being applied to define characteristics of pathogenic behavior by this important pathogen. The major goal of the work is to devise rapid techniques for differentiating pathogenic strains of the fungus in order to predict disease intensity from standard soil and seedling sampling. This work is being conducted in cooperation with the University of British Columbia and Oregon State University.

2. Epidemiology of Cylindrocarpon spp. on container-grown seedlings: several investigations were continued to characterize fungal species involved in disease, assess pathogenicity, and formulate procedures to reduce losses. An evaluation to investigate fate of Cylindrocarpon spp. on outplanted white pine seedlings and their role on seedling performance was conducted in cooperation with the University of Idaho and Potlatch Corporation.

3. Pathogenic potential of Fusarium spp. on conifer seedlings: techniques to evaluate potential of Fusarium isolates to elicit disease on young conifer germinants are used to quickly screen isolates. Soil isolates of F. oxysporum showed wide variation of virulence, whereas isolates of F. proliferatum were usually similar in their high virulence in these tests. Pathogenic behavior information was supplemented with recent genetic work indicating low genetic variability in tested isolates of F. proliferatum. This genetic work is being conducted in cooperation with the University of British Columbia.

4. Biological control of nursery root diseases are being investigated. Commercially-available materials are tested for their efficacy in control of soil-borne pathogens. Thus far, no efficacious preparations have been found, but efforts will continue in this area. Of particular interest is evaluation of seed dressing organisms that may confer resistance to commonly-encountered root pathogens.

COMMON AND SCIENTIFIC NAMES OF INSECTS

Balsam woolly adelgid	*Adelges picea* (Ratzburg)
Boxelder leafroller	*Caloptilia negundella* (Chambers)
Cone feeding adelgid	*Pineus coloradensis* (Gillette)
Cone moth	*Eucosma recissoriana* Heinrich
Cone worms	*Dioryctria* spp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopk.
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Fir engraver	*Scolytus ventralis* LeConte
Gypsy moth	*Lymantria dispar* (L.)
Lodgepole terminal weevil	*Pissodes terminalis* Hopping
Mountain pine beetle	*Dendroctonus ponderosae* Hopk.
Pine engraver	*Ips pini* (Say)
Pine needle sheath miner	*Zelleria haimbachi* Busck
Red turpentine beetle	*Dendroctonous valens* Le Conte
Rusty tussock moth	*Orgyia antiqua* (L.)
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Tip moth	*Rhyacionia zozara* (Kearfott)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western conifer seedbug	*Leptoglossus occidentalis* Heidmann
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shootborer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

COMMON AND SCIENTIFIC NAMES OF DISEASES

Annosus root disease	*Heterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.) Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Pk.
Conifer-Aspen rust	*Melampsora medusae* Thum.
Conifer-cottonwood rust	*Melampsora occidentalis* Jacks.
Cylindrocarpon root disease	*Cylindrocarpon* spp.
Cytospora canker of firs	*Cytospora abietis* Sacc.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.) Dyko
Dutch elm disease	*Ceratocystis ulmi* (Buism.) C. Mor.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needlecast	*Elytroderma deformans* (Weir) Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Fir needlecast	*Lirula abietis-concoloris* (Mayr:Dearn) Darker
Fir needle rust	*Pucciniastrum epilobii* Otth
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.) Ell. & Ev.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needlecast	*Meria laricis* Vuill.
Lodgepole pine needlecast	*Lophodermella concolor* (Dearn.) Dark.
Marssonina blight	*Marssonina populi* (Lib.) Magn.
Phoma blight	*Phoma* spp.
Pine needle rust	*Coleosporium sp.*
Pythium root disease	*Pythium ultimum* Trow.
Red ring rot	*Phellinus pini* Pilat.

Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd. *Rhabdocline weirii* Parker & Reid
Schweinitzii root/butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Shepard's crook	*Venturia macularis* (Fr.) E.Muller & Von Arx
Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Stalactiform rust	*Cronartium coleosporioides* (Diet. & Holw.) Arth.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.
Spruce mottled needlecast	*Rhizosphaeria kalkhoffii* Bud.
Swiss needle cast	*Phaeocryptopus gaeumannii* (Rhode) Pet.
Tomentosus root disease	*Inonotus tomentosus* (Fr.) Gilb.
Western gall rust	*Endocronartium harknessii* (Moore) Hir.
White pine blister rust	*Cronartium ribicola* Fisch.
White pine needlecast	*Lophodermella arcuata* (Darker) Darker

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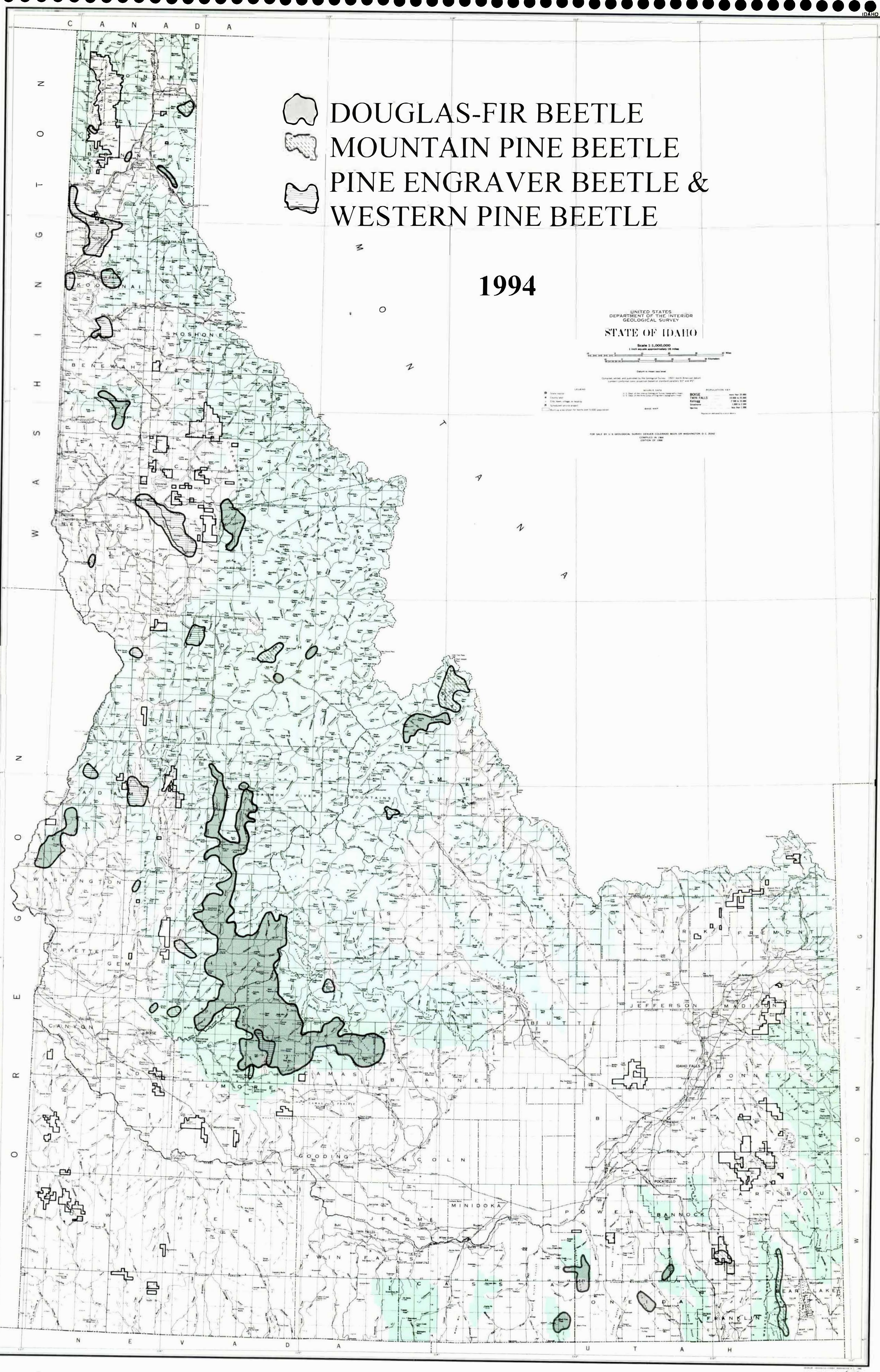
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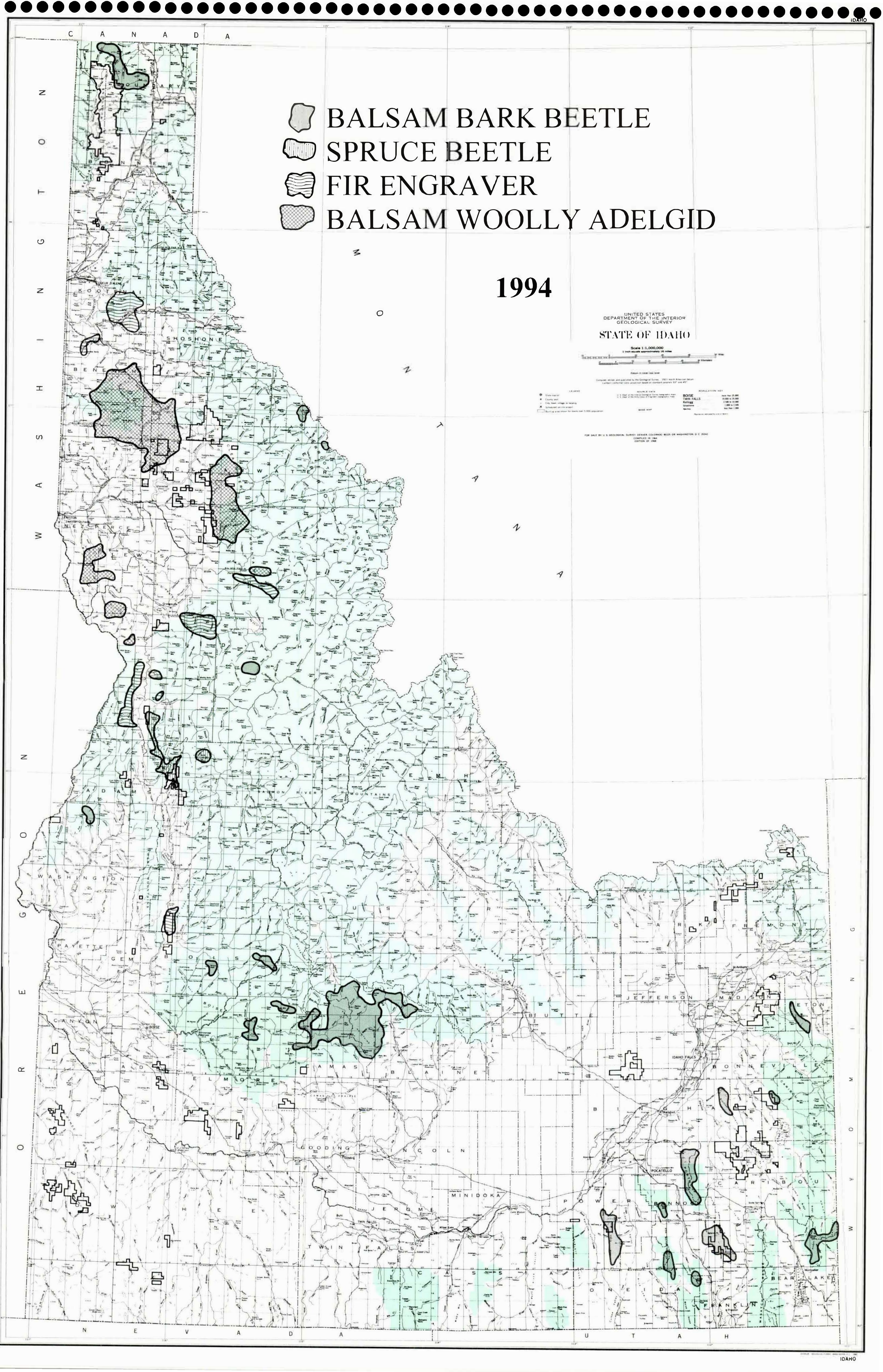
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